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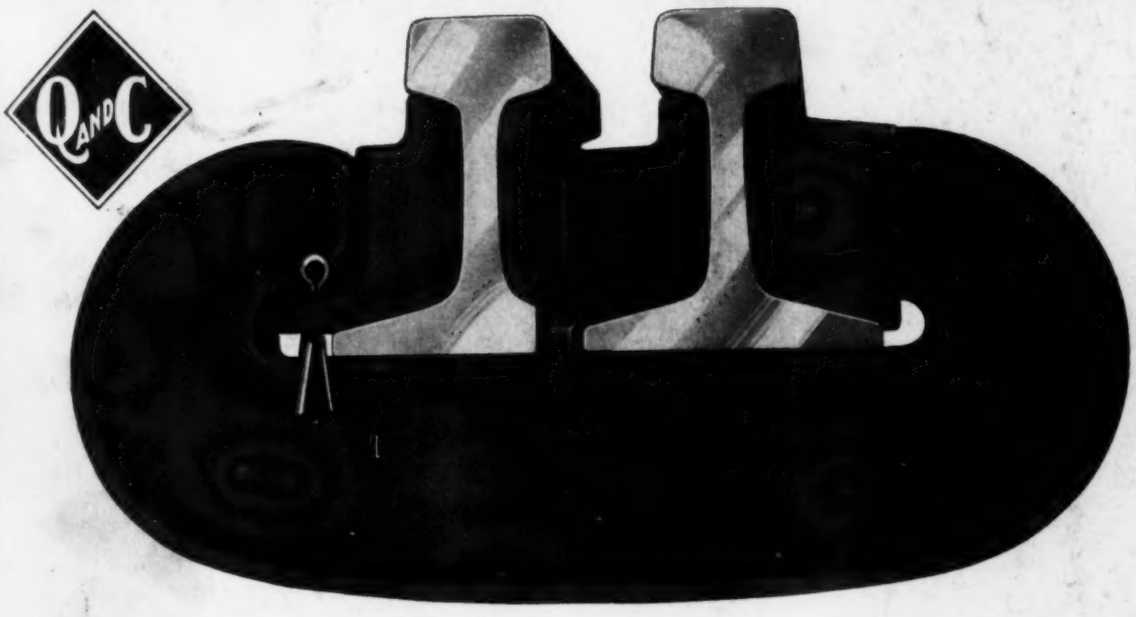
Railway Age

DAILY EDITION

FIRST HALF OF 1924—No. 14 CHICAGO—**FRIDAY, MARCH 14, 1924**—NEW YORK SIXTY-NINTH YEAR

Published weekly by Simmons-Boardman Pub. Co., 30 Church St., New York, N. Y. Subscription Price U. S., Canada and Mexico, $6.00; foreign countries (excepting daily editions), $8.00; single copies, 25c. Entered as second-class matter, January 30, 1918, at the post office at New York, N. Y., under the act of March 3, 1879. Daily edition application made at the post office at Chicago, Ill., for entry as second-class matter. Chicago office, 608 S. Dearborn St.



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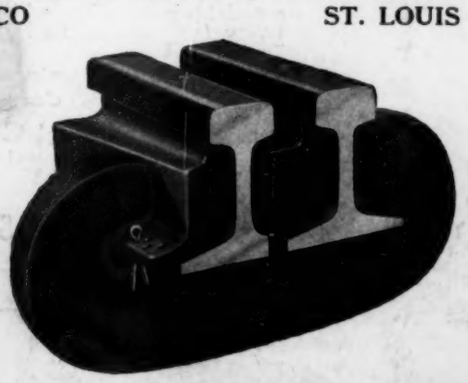

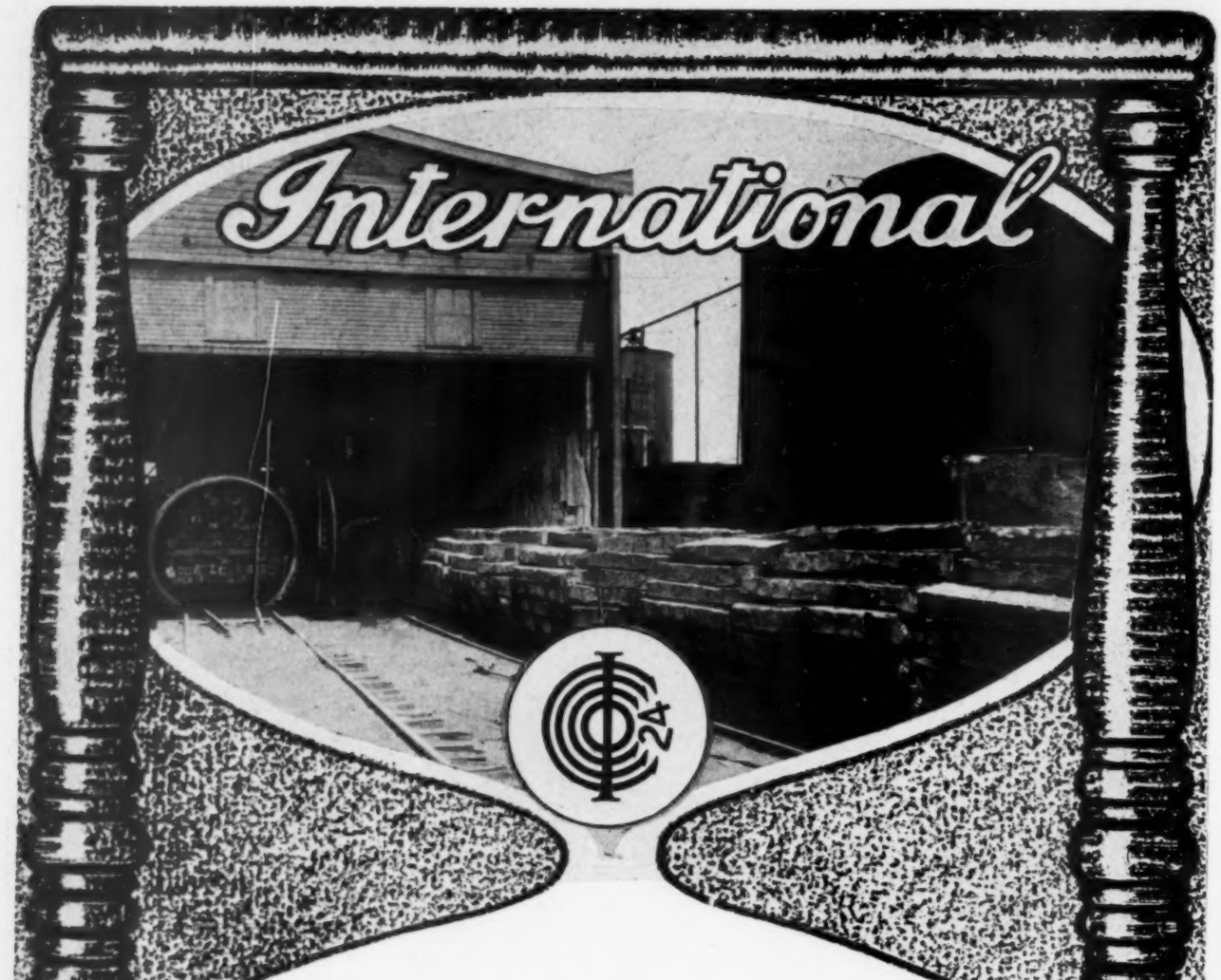

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EDITORIAL

Railway Age

DAILY EDITION

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Today's Signal Section Program

Morning session, 10 a. m. to 12:30 p. m.; afternoon session, 2 p. m. to 5 p. m.

Economics of Railway Signaling.
Power Interlocking
Direct Current Automatic Block Signaling.
Overhead and Underground Lines.
Unfinished business.
New business.
Reports for discussion.
Election announcement.
Adjournment.

Training for Leadership

Reference was made in the report of the Committee on Economics of Railway Labor to foremen's training courses. Marked progress has been made in this direction on the railways during the past year. Exact figures as to the number of clubs or training courses now functioning would undoubtedly come as a distinct surprise, even to those who have followed these developments most closely. The foremen's groups, which in most cases include subordinate supervisory officers regardless of their title, vary widely as to the character of their meetings and their programs. One thing, however, is ordinarily clearly emphasized and that is the necessity of training for leadership. The old-time type of "driver" foreman is not nearly as prevalent now as it was a few years ago. It is leaders, not drivers, that are needed. It is steadily becoming more generally recognized that the question of successful leadership is more or less an art or a science. Much study and research have been directed in recent years to developing the fundamental principles of successful leadership. More and more practical material along these lines is steadily becoming available. Not a few of the industrial organizations have taken advantage of this and usually with quick and tangible results. It is a good sign, therefore, that so many of the railroads are becoming interested in this development.

Stabilization of Employment

The loss of a job is a much more serious thing for the worker today than it was a number of years ago. The railroads have been notoriously guilty in cutting down and building up their maintenance of way and maintenance of equipment forces as traffic has fluctuated. This is a costly process to the railroads because of its effect upon the morale and the actual cost of rebuilding the organization when business picks up. Some roads are making an effort to put these classes of work on an annual budget system and maintain more nearly uniform forces throughout the year. The difficulty in bringing this about is that it has been almost impossible to secure accurate data as to the cost of rebuilding the organization and thus to make a real case with those who have to do with the financial management of the property. It should be possible to determine this cost with a fair degree of accuracy although obviously it will acquire painstaking and thorough analysis and research. The importance of improving the situation is so great, however, that it would seem that no effort should be spared to develop the real facts.

The Necessity for More Publicity

Is the work of the American Railway Enginering Association sufficiently appreciated by the railways in general? Among those who are familiar with the thorough manner in which it proceeds the value of its conclusions is placed second to no other association in the railroad field. However, this knowledge is confined largely to the 2,200 men enrolled in its membership, whereas its conclusions are of value to the entire railway world, including many executive officers who are acquainted with the association only in a very general way. It is one thing to do a good piece of work. It is another and equally important task to bring about a proper acquaintance with and recognition of this work. The old saying that a man need only to build a good rat trap and the world will blaze a trail to his door has long since been exploded among business concerns. Its application is equally direct to organizations such as the American Railway Engineering Association. The members of this organization are qualified by training, experience and ability to speak authoritatively upon many problems involved in the construction, maintenance and operation of railways. They are also qualified to lead public thought in the consideration of the many problems affecting transportation today. The preparation of a program for the annual dinner last Wednesday evening of a sufficiently authoritative and general character to permit its broadcasting by radio brought the American Railway Engineering Association to the attention of thousands of railway people in a way which was not heretofore possible. In presenting a program of this character

the A. R. E. A. rendered a real service to the railways and incidentally placed itself before the public in a valuable light.

A Radio Fan

Some of the guests at the dinner on Wednesday evening wondered just how well the voices of the speakers were carried by radio. This was particularly true of Sir Henry Thornton because he apparently made no effort to talk directly to the radio receiver but seemed rather to enjoy talking in a more or less intimate way to all of the large audience throughout the length of the Gold room. His voice, however, went over the radio in splendid shape. This is not to be wondered at when one learns that he talks regularly, and at least once a week, over the radio to Canadian National employees. The road owns one broadcasting station at Ottawa and has arrangements for the use of other stations. Sir Henry and his associates, including departmental chiefs, talk regularly to the 100,000 employees, giving them facts about the operation and progress of the railroad and explaining how they can be helpful in different ways in securing better results. The road has even gone to the length of making arrangements so that the employees can buy radio sets at a low cost and under reasonable terms. It is difficult to estimate the importance of this in helping to build up a spirit of teamwork among the employees as a whole and in getting them to take a more active and intelligent interest in the operation of the property.

What Load Must a Culvert Carry?

THE DISCUSSION of the report of the Committee on Masonry yesterday morning brought forth considerable reference to the long-enduring theory of arch action in embankments as a factor in relieving culverts of a portion of the imposed load. It was clear from the remarks that many of the speakers subscribe to this theory, citing personal observations to support their opinions. It would seem, however, that such illustrations as that offered by Mr. Morse, where culvert pipes rendered excellent service after having been braced during the period of solidification, demonstrates the effect of the development of lateral support. While this is of vital importance in the case of culvert pipes, it is of no benefit to the cover of a box culvert.

The nail was hit squarely on the head by Mr. Leffler when he expressed his inability to understand what nature could do to take some of the load off the culvert and impose it on the filling placed on either side of the culvert, and his position was supported by the remarks of Professor Talbot and Dean Marston, whose studies indicate that, in some cases at least, the culvert carries a greater dead load than that represented by the weight of the superimposed prism of earth.

Mr. Loweth probably did more than any other speaker to clear up the misunderstanding when he called attention to the fact that the proportion of the load carried by a culvert is dependent largely on the relative settlement of the culvert and the filling or natural ground on either side of it. A culvert supported on piles or with footings carried through soft material to rock must carry a much larger share of the load than one placed on yielding material. In view of this, it would seem that the committee's conclusion that a culvert should be designed to carry a dead load equal to the weight of the superimposed prism is the most logical solution of the problem.

LeRoy Wyant is the acting signal engineer of the Chicago, Rock Island & Pacific, with headquarters at Chicago, instead of Fred Wyant, as stated in our issue for March 13.

* * *

J. L. Phillips, manager of the Atlanta office of the Okonite Company, has been transferred to San Francisco as the manager of the San Francisco office of this company. Mr. Phillips plans to take charge of this office about April 1.

* * *

Members of the A.R.E.A. who live in Chicago learned yesterday that their families kept a close check on them at Wednesday's dinner, thanks to the radio. One man who started to tell his wife one of the stories over the phone found that there was nothing to tell, for she had already heard it.

* * *

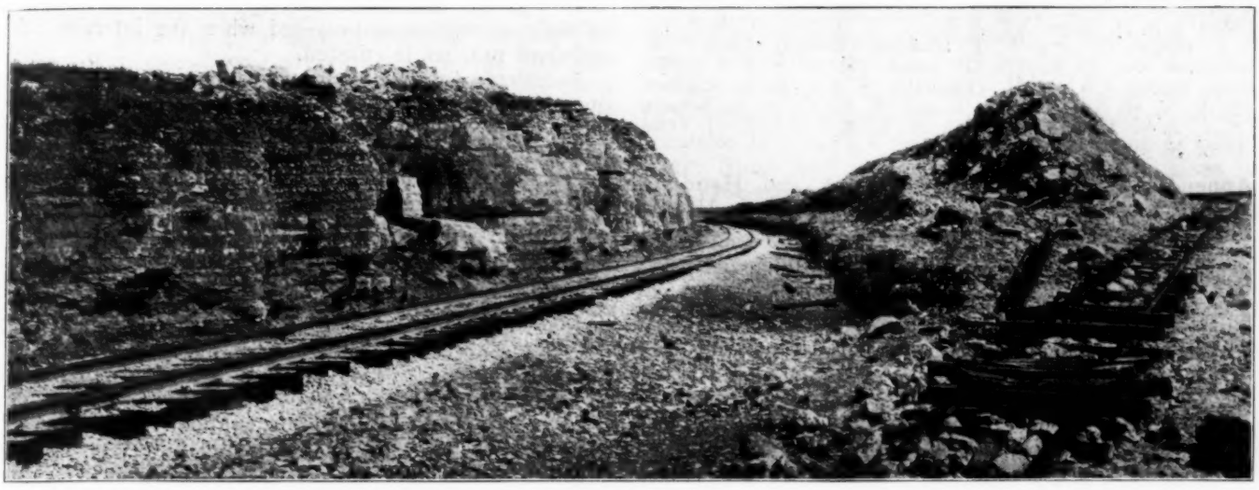
M. A. Baird, signal engineer of the Erie, has to his credit the record of obtaining the largest number of new members for the Signal section and its predecessors during the 29 years of its existence. He is credited with the addition of 57 names to the membership at the conclusion of the 1924 convention.

* * *

The report of the Committee on Economics of Signaling will be presented at the convention of the Signal section of the A. R. A. at the Drake Hotel at 10 a. m. instead of 11:45 a. m., as announced previously. It is expected that many engineering and operating officers will be present to hear this report, for whom an extra number of copies of the report and special studies connected with it will be available.

* * *

Telegraphic instructions were received from the New York Central general offices at New York requesting H. S. Balliet, assistant terminal manager and secretary of the Signal section; F. B. Wiegand, signal engineer of lines west, and W. H. Elliott, signal engineer of lines east, to return to New York at once and to bring with them all signal supervisors and signal inspectors on the New York Central. A special car was attached to the Lake Shore Limited last night for their use. No information was obtainable as to the nature of the emergency requiring their return. C. H. Morrison, signal engineer of the New York, New Haven & Hartford, was also requested by his road to return with W. F. Follett, assistant signal engineer. Approximately 25 men left the meeting of the Signal section because of this order. The supposition is that local storms have caused heavy damage along the eastern seaboard, as the Southern railway has 85 miles of pole line down, because of which fact J. B. Lamb, signal engineer of the Southern, had to leave for his headquarters.



In the Flint Hills on the Eldorado Cut-off of the Santa Fe in Kansas

A. R. E. A. Completes Most Successful Year

The Members Devoted Two Long Sessions to Consideration of Reports—New Officers Installed

THE TWENTY-FIFTH annual convention of the American Railway Engineering Association came to a close shortly before five o'clock yesterday afternoon, concluding the most successful meeting in the history of this organization. Greater interest was shown in the reports of the committees than in any previous year, the Florentine room being well filled until adjournment. As indicated in another column, the registration also exceeded that of any previous year by 15 per cent. In contrast with some previous years the interest in the reports presented on the closing day equalled that earlier in the sessions and the discussion of the last reports was as valuable as that of any preceding day.

Reports were presented by the committees on Rules and Organization; Signs, Fences and Crossings; Masonry; Records and Accounts; Economics of Railway Labor; Wood Preservation and Co-operative Relations with Universities. Following the consideration of these reports the officers for the ensuing year were installed.

Report on Economics of Railway Labor

The relationship between employer and employee has a certain definite effect which is beneficial to both only when it is harmonious. Although the roads have made some progress along the lines of establishing a better bond between the managements and the employees, this work is in its infancy. This year the Committee on Economics of Railway Labor discussed the subject in detail in a report on methods for obtaining and handling railway employees, which involved a series of studies on the methods in use in other industries. The committee also presented a study of standard methods for performing maintenance of way work for the purpose of establishing units of measure. C. C. Cook, the new chairman, has been a member of the Committee on Economics of Railway Labor for the last four years.

C. C. Cook
Chairman

THE COMMITTEE presented reports on the following subjects:

Method for obtaining and handling railway employees (studying methods in use in other industries) in an Appendix A; and on standard methods for performing maintenance of way work for the purpose of establishing units of measure of work performed in an Appendix B. It recommended that conclusions 1 to 7 inclusive in Appendix A be approved for publication in the Manual and that conclusions 1 and 2 in Appendix B be approved for publication in the Manual.

Committee: C. C. Cook (B. & O.), chairman; W. H. Penfield (C. M. & St. P.), vice-chairman; A. F. Blaess (I. C.), A. S. Butterworth (M. S. B. & P.), A. Craine (C. B. & Q.),

L. E. Dale (Penna.), John Evans (M. C.), R. H. Ford (C. R. I. & P.), R. H. Gaines (T. & P.), L. C. Hartley (C. & E. I.), J. L. Haugh (U. P.), E. T. Howson (*Railway Age*), C. E. Johnston (K. C. S.), F. G. Jonah (St. L.-S. F.), J. W. Kern, Jr. (I. C.), G. M. O'Rourke (I. C.), R. L. Pearson (N. Y. N. H. & H.), A. N. Reece (K. C. S.), R. L. Schmid (N. C. & St. L.), J. L. Starkie (G. C. & S. F.), C. H. Stein (C. of N. J.).

Appendix A—Method for Obtaining and Handling Railway Employees (Studying Methods in Use in Other Industries)

The committee concentrated its attention, in the study of this subject, to the investigation of the plans developed by other large employers of labor to promote continuity of service and efficiency in production. Individual members of the committee have investigated those organizations whose results have been noteworthy, giving preference as far as possible to those companies whose operations have extended over a wide area and to those methods which are applicable to the conditions found in railway service.

In its investigations, the committee found that the outstanding feature of all data collected is the emphasis placed upon co-operation in industry and that the recognition of the distinctive rights, responsibilities and obligations of employers and employees has been the foundation on which the plans in all industries rest. A harmonious understanding of the proper relationship between officers, foremen and workmen of an organization is a basic requirement.

It is in the establishment of proper methods to accomplish such a purpose that enlightenment from the experience of those other industries most closely related to the railroad industry is of service. The methods that have been investigated by the committee may be grouped under the following descriptive headings:

(1) Personnel Departments:
  (a) Employment, promotion and transfer.
  (b) Education, training and service.
    (1) Foreman's training courses.
    (2) Apprentice systems.
  (c) Discipline and separation from service.
(2) Employee Representation in Management.
(3) Benefit Associations:
  (a) Insurance, providing for
    Sickness
    Accident
    Unemployment
    Superannuation
    Death
  (b) Savings funds
  (c) Loan provisions.
(4) Stock Ownership.
(5) Welfare:
  (a) Working conditions.
  (b) Safety, health, etc.
  (c) Rest-houses, rest-rooms, meals, etc.
  (d) Recreation.
  (e) Homes.
(6) Incentive Plans:
  (a) Standards and units of measure.
  (b) Bonus payment.

Personnel Department

Those railway and other companies which have personnel departments demonstrate the benefits derived from the unbiased and helpful treatment of their employees from the date of their entrance into service through all the period of their employment. These departments commonly handle all applications for employment and are responsible for the employee meeting the company's requirements as to ability, physical condition and mental qualifications. Records of service of employees and continual contact with the men are maintained to see that their service is mutually satisfactory, transfers made where occasion requires and equal opportunity for promotion given. Education of employees in the technique of their occupation is provided when the interests of a sufficient number is enlisted.

Foremen's training courses, originating upon the request of a sufficient number of employees but assisted by a 50-50 contribution upon the part of the management, have been operating in many establishments with mutually beneficial results. Recognition of meritorious service and report of disciplinary action is frequently given to this department and is closely followed by it in the records of service to see that absolute fairness is accorded.

Employee Representation in Management

Plans of employee representation in management were found to be quite generally in use by the companies investigated. The guiding principle in their establishment was the avowed intent of the managers to insure a "square deal" and a real spirit of co-operation. The plans are organized along similar lines, though differing in detail. Usually there are established "works councils" or "conference committees" with equal representation by employee and management representatives independently chosen. Periodical meetings of these councils are held at which any matters of mutual interest are discussed.

Wage negotiations, working conditions, hours of labor, disputes, suggestions for improvements, grievances, etc., are taken up in these conferences and agreements reached where possible. In case of disagreement there is the right of appeal to similarly constituted committees as represented by a "general council" which consists of employees' and management representatives for an entire plant or an industry. Provision is made to carry appeals finally to boards of directors and even beyond to two outside arbitrators chosen respectively by each party, a third being chosen by the two appointed.

Testimony has been given to the comparatively few disputes which have been carried beyond the works' council, even in industries where employee representation plans have been in existence for five years and more.

All of these companies stress the point that the plans are designed to give the employees a voice in the management, particularly where their own interests are at stake. The real objective is harmony and cooperation. Open dealing and sincerity with no ulterior motive or suggestion of purpose other than that of mutual helpfulness are basic fundamentals of such plans.

That they have been so founded and that the results have been of immeasurable benefit to those industries now continuing the plans is evidenced by the testimony of the responsible officers of those organizations and by the very fact of their continued existence.

While the participation of the employees is quite common in the management of many industries, this plan has been tried only to a limited extent in railway service.

Benefit Associations

Among the plans affecting the welfare of employees which have been adopted most freely by the railways and other industries alike are the establishment of insurance funds giving protection against the five main hazards of life, viz., sickness, accident, unemployment, superannuation and death. For many years relief associations have existed on a number of railways as well as in other industries which have incorporated plans for insurance covering all of these hazards except unemployment. Nearly 50 of the largest railways of the country have in effect pension systems for employees retired or incapacitated for service. Some of these roads also include provisions for savings funds and loans. More recently, at least one railroad has included unemployment insurance in its plan. The outside industries investigated were generally found

to have in effect insurance plans which covered variously some of the benefits above listed.

In the operation of a relief department, which embodies all of the above features excepting the provision for unemployment, on one of the leading railroads for a period of more than 40 years, there is evidence of its value not alone to employees but to the company itself. The sick benefits, the pensions, the opportunities providing for savings in a guaranteed fund, and the advantages accruing from the privilege of borrowing from that fund in order to build a home, make an appeal to loyalty that could only be secured through such tangible evidence of the good faith and good-will of the company itself.

A few large railroad systems are now carrying group insurance in which 50 or more employees are insured under a policy issued to the employer by an outside insurance company, the premium being paid wholly by the employer or jointly by the employer and employee. There is in this group insurance movement the evidence of the desire to emphasize the importance of human interest in the relationship of employer and employee. It is an advance step in affording economic security for the employee and his family. When that is established and when fear of the hazards of life are removed through insurance provisions for dependents, there is beginning the elimination of much of that discontent that now results in the uneconomic movements among workers.

Stock Ownership

Plans for the participation by employees in the ownership of the industry from which they gain their livelihood through the purchase of its stock have received a great deal of attention from some of the largest and most successful industrial corporations. These plans have also been followed for a number of years by some of the railways and have been adopted by others within recent months. One corporation in this country, having probably the largest number of employees, has had such a plan in effect for 20 years. Another company has had such a plan in effect for a number of years. The success of those two companies alone makes it incumbent upon railways whose work is similarly diversified and whose employees rank in numbers, to study their results.

It must be recognized that employees in most groups other than the supervisory one depend upon group action for an increase in their wages. It would be socially undesirable to exert such an economic force as to restrict their freedom of action.

Welfare

Welfare work is widely and variously practiced in most American institutions. It ranges from simple provisions for healthful and safe conditions in the plants, to the establishment of departments that foster interest in athletics, recreation and entertainments of every character. In some cases it has extended to the appointment of investigators who visit the homes and families of employees periodically for the purpose of insuring healthful and comfortable conditions in the home-life of all employees. In the case of at least one of the largest of our manufacturing companies, such an investigation extended to the personal habits and thrift of their employees, though it is understood that the later practices of that department do not generally cover such investigation, being limited to such inquiry into the home-life as would develop the need for assistance in case of sickness or other misfortune which the company, according to its determination, elects to relieve.

Incentive Plans

Incentive plans have been extensively adopted by industries covered by the committee's examinations. The objectives were numerous, but in their aggregate were designed to avoid the waste due to absences, lateness and loafing, to develop interest and skill in the work, to increase production and to inspire loyalty and co-operation.

The investigation by the committee of companies which have adopted and are using standard production methods consisted largely of a review of various plans of piece-work, bonus and similar individual incentive plans in which the wage payment to the employee was based upon his individual performance. It is generally conceded that where there is any basis for measuring and rewarding individual effort, there is foundation for just and adequate compensation. Usually, it is only when such individual incentive plans based on production records are not possible of application, that companies have resorted to the other incentive plans of profit-sharing, bonus payments for avoidance of tardiness, and absence and prevention of waste, stock sales, etc., are made effective.

The principle of piece-work payment is fundamentally sound.

Where the work done by an individual is susceptible of definite measurement the most effective method of promoting efficiency is to establish a basis of payment resting upon the work performed. Such plans are in successful operation in industries such as cigar-making, garment-making, coal mining, and manufacturing plants where machine output can be definitely measured.

It has not been found that the number of companies which have discontinued piece-work plans constituted a very large percentage of the whole number that had adopted such plans, and it may be fairly concluded that there is not sufficient merit in such objections account of exhaustion of workers, impairment of quality, and destruction of the co-operative spirit as were advanced by these companies, to warrant condemnation of these piece-work and direct-bonus-payment plans as a whole.

Those plans had been rather extensively employed in railway shops and, in a few instances, in maintenance of way work for a number of years prior to federal control, and are now in a fair way to re-establishment in some of the shops where they were formerly in effect. In shops the piece-work plan is more directly applicable; in maintenance of way work a modified piece-work or a bonus plan is better suited by reason of the fact that production is usually measured for a gang rather than for an individual.

The use of such plans in maintenance of way work does not necessarily involve the payment of additional compensation, though it is evident that the ideal results would be attained only when such an end was successfully and practically accomplished. It has been found that the very establishment of a standard performance has had beneficial effect and that gangs that are subject of time-study or have been made acquainted with results of such studies have been inspired to match the standard and the results accomplished by other gangs.

The term "bonus" has been applied so indiscriminately to piece-work and other methods of payment of added compensation to employees that it is necessary to limit the meaning of the term in order to make it distinctive from other incentive plans. As here considered, it relates to extra compensation paid in order to secure length of service, avoidance of lateness and absence, prevention of waste and similar features of employment to which the employee may not feel obligated to give particular attention, but which results in loss to the company unless the practices are corrected.

Bonus payments to reduce absences, lateness and wastage are effective, but when added to the pay envelope

they may become sources of friction which result in defeating the ends they have planned to serve.

CONCLUSIONS

(1) In order to retain satisfactory employees, railway managements should provide means for the fullest possible co-operation between employer and employee, arranging for the education of all employees and particularly those in a supervisory capacity in the aims of the companies to secure that result.

(2) Where roads are of sufficient size to warrant the creation of a personnel department, it is recommended that such a department be established whose duties shall be the encouragement of employees and their handling without prejudice, in their (a) employment, promotion and transfer; (b) education, training and service, including foremen's training courses and apprentice systems; (c) discipline and separations from service. On smaller roads work of the character above outlined should be assigned to some officer in the existing organization, to be handled independently of his relation to any particular department.

(3) The adoption of a plan of employee representation in railway work will, through the improvement of the spirit of co-operation, serve largely to stabilize labor and reduce the problem of obtaining new employees.

(4) The extension of benefit associations providing insurance against the hazards of sickness, accident, superannuation and death is essential to the development of a loyal and co-operative spirit in railway organizations, which is needed to assist in the work of stabilizing labor and render it more efficient and economical. Savings funds and loan provisions placed at the disposal of all worthy employees are an added incentive of merit and of economic value.

(5) The promotion of the mutual interests of employers and employees through participation in the ownership of the industry on which they are dependent for their income in wages or dividends is an objective greatly to be desired and warrants the careful consideration of the railways as a means of stimulating co-operation in the common objective.

(6) Plans for the establishment of satisfactory working conditions, including the provision of sanitary and agreeable facilities while on duty, comfortable rest-houses, rest-rooms and dining-rooms, maintained in cleanly condition, and service of a sufficient quantity of wholesome food, should be in effect on all roads.

(7) The establishment of standards and units of measure for all work performed which is susceptible of measurement, is a fundamental basis of harmonious understanding between employer and employee and the foundation for economical and efficient handling of labor.

(8) The committee suggested for further examination and such use by individual companies as their judgment may determine, the following plans which have come under the investigations of this committee:

(A) Guaranteed Employment or Unemployment Insurance—These are prompted by the desire to provide continued employment, free the employee of anxiety and insure co-operation.

(B) Bonus payments for continued service, avoidance of lateness and absence, prevention of waste and other features of economic operation concerning which the employee may not have full realization of his obligation.

Appendix B—Standard Methods for Performing Maintenance of Way Work for the Purpose of Establishing Units of Measure of Work Performed

The Association adopted at the convention in 1922, for publication in the Manual, the report of this Committee, which outlined in detail a standard plan for study of methods and performances covering all items of trackwork. Upon reassignment of the subject to the committee, the membership considered it to be their duty to secure from the railways studies of the various items of trackwork, taking them up in the relative order of their importance. From an analysis of the data which it was hoped to secure, it was intended to submit to the Association recommendations as to the standard methods for performing those certain items of work, such as rail laying, tie renewals, ballasting, surfacing, etc., establishing at the same time units of measure of the work performed.

The committee's intent was to secure detail study of items of trackwork according to adopted form, which requires each manual operation entering into that work to be reported along with the time of its accomplishment. This will enable comparison of the items of work done under similar conditions and involving an equal number of operations. The data which is needed for such a purpose must necessarily be submitted uniformly in detail, so that an item of trackwork reported by one party be not compared with a similar item of trackwork until the conditions under which work is done, and the differences in the number of manual operations involved, are known.

The report on this subject submitted last year included a summary of the results obtained through requiring each section foreman of one of the large carriers of the Middle West to keep a record each day of the amount of work done and the hours consumed in performing it. The test has been continued through another year, and the results more extensively used in planning the work of foremen, allowing a specified number of man-hours for doing each class of work required. Satisfactory results in increased output and a better physical condition were obtained.

Early in the year a circular letter was sent out suggesting sample forms of time studies for renewal of crossties and rail, and in July it was followed with another requesting the railways to give us the benefit of the result of any investigation made in line with that letter and to extend the investigation to include surfacing, ballasting and ditching gangs.

A number of replies were received in the form required for comparative purposes, also some statistical data based on actual records. The committee submitted exhibits A to F, which are on statistical tabulations based on records of units of measure, and exhibits G to S, which are on time studies prepared according to the form requested by the committee, and are for the distinct purpose of assisting the committee in its determination of the best methods of performing the items of work covered.

Some quite valuable data pertaining to ballast tamping, stone ballast cleaning and ditching were received from several roads, but the committee needed more studies from the railways in order to warrant definite recommendations as to economical practices in connection with the utilization of machinery in these, as well as other types of maintenance work.

CONCLUSIONS

(1) The making of time studies and the comparison of performances of an individual gang with a standard, increases the efficiency of the gang under observation and of other gangs which are made acquainted with results.

(2) The general use of standard methods and units of measure of performance on divisions and districts of a railway has resulted in increasing the efficiency of track forces.

Discussion

(The report of the committee was introduced by C. C. Cook, chairman, who outlined briefly the work which the committee had been doing, and then turned

over the presentation of the sub-committees to their respective chairmen. E. T. Howson, *Railway Age*, presented the reports on the methods of obtaining and handling railway employees. *It was then moved that Conclusions 1 to 7 be adopted for publication in the Manual.)*

G. J. Ray (D. L. & W.): Just what is intended by the employment of a special officer or by the selection of someone from the organization to take over the particular work that is numerated in the paragraph that states, "Where roads are of sufficient size to warrant the creation of a personnel department, we recommend that such a department be established whose duties shall be the encouragement of employees and their handling without prejudice, in their employment, promotion and transfer"? It has been my experience that the particular officer in any department of maintenance of way who has the success of his work at heart is more interested in the welfare of his men than any other man on the railroad, and certainly more than some man that is employed in an outside capacity.

Mr. Howson: We all know that certain officers are more successful in recruiting the proper class of employees and holding them in service than others, whether it be a foreman, track supervisor or division officer. A personnel officer would not attempt to step in and usurp those duties, but he would advise with the man who is less successful, co-operate with him, suggest to him wherein his methods may be deficient, give him that benefit of the other man's experience. We know that what is everybody's work may be nobody's work; at least we do not get the concentration of attention on this important subject that we would get with an organization. For a man to transfer from one branch of railway service to another is commonly to require him to quit and start again. The personnel department might be the means of transfering men who desire to change from one department to another, rather than forcing them to leave the service in order to start again. In other words, it would co-ordinate the employment conditions in various departments.

(Motion carried.)

(Conclusion 8 was next received as information, following which G. M. O'Rourke (I. C.) presented the committee report on methods for performing maintenance of way work for the purpose of establishing units of measure of work performed. *It was moved and carried that Conclusions 1 and 2 in Appendix B be approved for publication in the Manual.* The committee was then excused with the thanks of the Association.)

Report of the Committee on Masonry

The report of the Committee on Masonry is confined to three subjects —revision of the Manual, a study of design loadings for culverts and a statement of progress in the improvement in concrete construction practices. Changes in the Manual embody the revision of some definitions and the specifications for stone masonry. The study of design loadings comprises an effort to develop a logical formula for determining the effect of live load, impact and embankment load on the covers of culverts. The last portion of the report shows that railway engineers are keenly alive to the possibilities of improving practices in concrete work and that important progress may be expected in the future. This is C. C. Westfall's second year as chairman and his fifth year as member of the committee.

C. C. Westfall
Chairman

THE COMMITTEE recommended that action be taken on its report as follows:

(1) That the report given in Appendix "A," on Revision of the Manual, be accepted and the recommendations therein be accepted and incorporated in the Manual

(2) That the report given in Appendix "B," relating to the distribution of loads through embankment, be accepted as a progress report only, with a request for comments from the membership of the Association.

(5) That the report given in Appendix "C," on the Development in the Art of Making Concrete, be accepted as information.

Committee: C. C. Westfall (I. C.), chairman; T. L. D. Hawden (C. M. & St. P.), vice-chairman; J. T. Andrews (B. & O.), R. Armour (C. N. R.), T. L. Condron (Con. Engr.), W. A. Christian (City of Chicago), A. O. Cunningham (Wabash), G. J. Bell (A. T. & S. F.), H. M. Brown (F. E. C.), C. P. Howes (T. & P.), J. E. Freeman (Nat. Conc. Spl. Co.), S. C. Hollister (Con. Engr.), Richard L. Humphrey (Con. Engr.), A. A. Johnson (Com. on Marine Piling), Paul Kircher (Massey Con. Prod. Co.), W. S. Lacher (*Railway Age*), J. A. Lahmer (M. P.), A. N. Laird, C. N. R.), C. P. Richardson (C. R. I. & P.), F. E. Schall (L. V.), L. W. Skov (C. B. & Q.), D. A. Tomlinson (Port. Cem. Assoc.), Job Tuthill (P. M.), J. J. Yates (C. R. R. of N. J.).

Appendix A—Revision of Manual

DEFINITIONS

Proposed Form

Bench Wall.—The abutment or side wall of a culvert.

Block Rubble.—Field or rough stone of large or massive size, as it comes from the quarry.

Culvert.—A small opening through a roadway or embankment. Note.—The differentiation between culvert and bridge is usually determined by arbitrary limits of span, depth of cover, etc.

Footing.—A foundation course.

Grout.—(Noun) A fluid mixture of cement and water or of cement, sand and water.

Grout.—(Verb) To fill the joints and smaller voids in masonry with grout.

Soffit.—The under side of a beam, slab, arch, lintel or other projection.

Spandrel Wall.—The wall above the extrados of an arch and below the coping or the string course.

Ashlar.—Face stone, usually of rectangular dimensions, squared or cut on beds, face and ends and sometimes on back.

Backing.—That portion of a masonry wall or structure built in the rear of the face course.

Cramp.—A bar of iron having its ends turned at right angles to the body, to enter holes in the upper side or face of adjacent stones.

Dry Masonry.—Masonry in which stones are laid up without the use of mortar. (See Masonry under General Definitions.)

Crushed Slag.—Air-coiled, blast furnace slag of sizes specified under "Coarse Aggregate."

Crushed Stone.—Crushed natural rock of sizes specified under "Coarse Aggregate."

Form.—A temporary structure or mold in which to cast concrete.

Laitance.—A film or layer of scum consisting of the extremely fine particles which separate from freshly deposited mortar or concrete and collect on the top surface.

Monolithic Concrete Construction.—A mass of concrete built without joints by a continuous operation.

Tremie.—A cylindrical or other form of tube, with a funnel top or pocket used for depositing concrete in water.

Specifications for Natural Cement

It is recommended that matter now in Manual under this subject be eliminated. So far as the committee can ascertain, the use of this material has been practically discontinued and the specification is no longer of practical value.

Specifications for Stone Masonry

(Omitted.)

Specifications for Constructing Pre-Molded Concrete Piles

The following change is recommended:

Paragraph 7.—Minimum temperature limit to be changed to 50 deg. (To be consistent with paragraph 26 of the Specifications for Plain and Reinforced Concrete.)

Specifications for Driving Pre-Molded Conrcete Piles

Paragraph 7 is considered somewhat ambiguous and open to misunderstanding, and the following wording is recommended:

"Driving shall be continued until plan cut-off is reached or until the rate of penetration specified by the Engineer is obtained."

Appendix B—Principles of Design of Concrete, Plain and Reinforced, for Use in Railroad Structures

In approaching this subject, the committee has outlined its work to determine first the external loads for which concrete structures are to be designed. The indeterminate questions involved are: the effect of impact upon a structure beneath ballast or earth fill; distribution of the live load through ballast and earth fill, and the proportion of the weight of the earth fill immediately over the structure which is carried by the structure.

The first step in determining these points involved developing the theoretical distribution of the loads with such empirical rules as may be accepted at the present time as representing the best practice. It seems to be a general opinion that a line on a slope of one-half horizontal to one vertical represents a conservative lateral distribution of load through an earth fill.

The impact formula and the amount of impact used in the design of different types of structures are matters upon which there is considerable difference of opinion. In the case of a concrete box or arch, where the dead loads are of considerable magnitude, it seems desirable to use an impact formula in which the dead load is a determining factor, rather than impact formulas ordinarily accepted in steel design where the length of structure and not the dead weight is a factor.

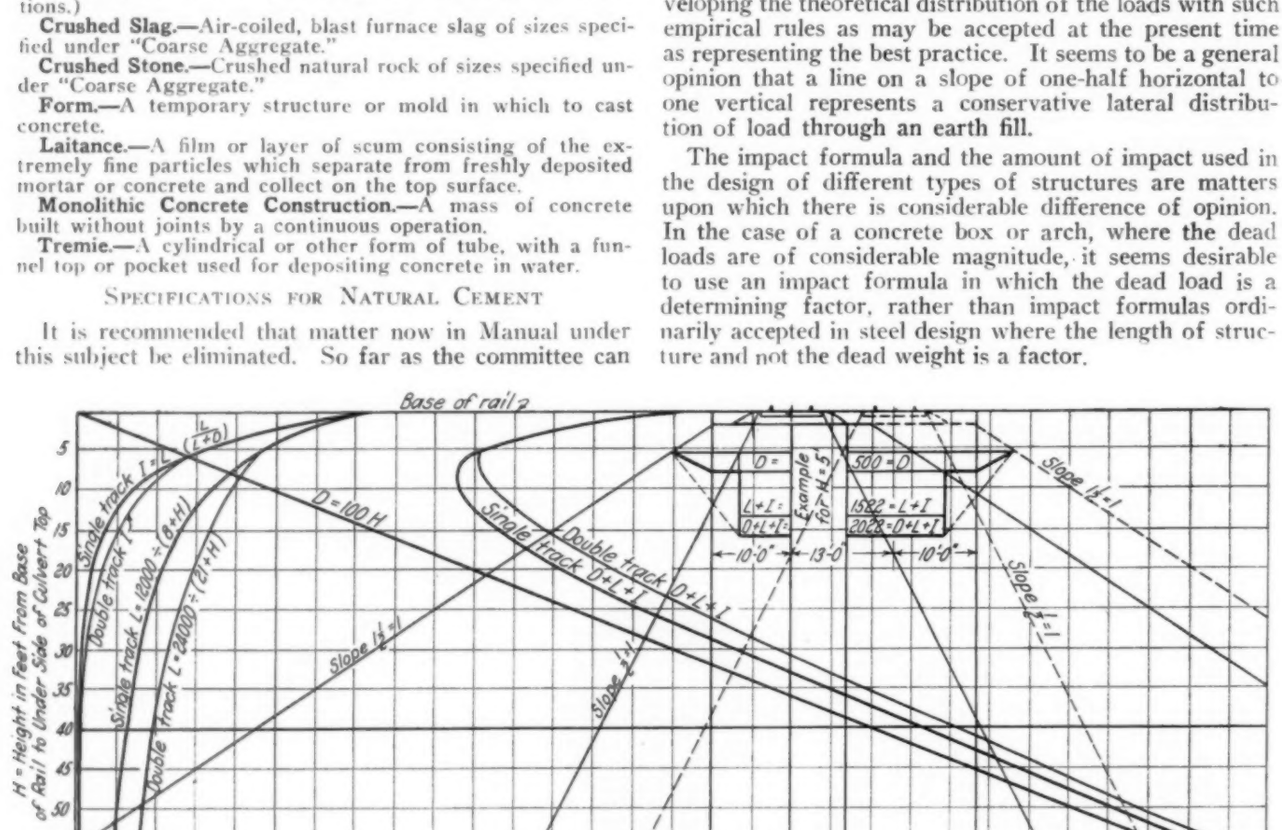


Diagram of Proposed Design Loads for Culverts

In the present instance, therefore, the committee has tentatively adopted the impact formula $I = \frac{L^2}{L + D}$ where L is the live load and D the dead load.

The committee has prepared and presents herewith diagrams based upon these assumptions. The live load is taken as Cooper's E-60 loading or for this purpose as equivalent to a uniform load of 12,000 lb. per lin. ft. of track. The dead load is taken as the actual weight of the fill and track and is assumed to weigh 100 lb. per cu. ft., the depth being taken from base of rail to the underside of the slab of the structure. The lateral distribution of the live load is determined by assuming the live load to be distributed from the ends of the tie on a slope of one-half horizontal to one vertical.

The curves represent the loads obtained on the basis outlined. The committee has given a great deal of study to these curves, but is not yet prepared to make recommendation on the application of these curves to actual design, it being felt that certain modifications are necessary for the lesser depths of fill.

The committee expects before attacking the theoretical design of structures to make further studies and prepare recommendations on lateral distribution of live load

as applied to slabs in unit construction where the slabs are of minimum width and similar questions, which at the present time involve more or less arbitrary decisions on the part of the designing engineer and where there does not seem to be any great uniformity of practice.

The committee realizes that the answers to the questions under consideration will depend for their value upon their relation to the best accepted practice and feels that any recommendations of the committee which will not meet with the general approval of the designing engineers of the railroads will be useless.

This preliminary report is, therefore, being submitted in the hope that it will elicit constructive criticism from the members of the Association, from which the committee will be able to develop a recommendation which can be accepted as reflecting the best of the present-day practic.

Appendix C—Development in the Art of Making Concrete

Last year's report briefly summarized the more important principles for placing high-grade concrete, which have been developed through years of laboratory study. It also reviewed the results obtained by a number of industrial organizations who are applying these principles on extensive concrete work. This year the committee has devoted the greater part of its time to a study of similar work being done in connection with various railroad projects.

Cleveland, Cincinnati, Chicago & St. Louis

Particular attention has been given to an important project of the Cleveland, Cincinnati, Chicago & St. Louis Railway at Sidney, Ohio, consisting of sixteen concrete structures on a 6.7-mile cutoff, the largest structure being an open spandrel arch bridge across the Miami river, consisting of three 140-ft. spans and two 100-ft. spans.

The importance of this particular structure demanded concrete of the highest quality and offered an excellent opportunity to apply the principles recommended in previous reports of this committee. These methods, developed through laboratory experiments, have been described in previous reports, and had been successfully applied in several highway and building operations, although they had not been used to any extent in railroad work. There was some doubt as to the possibility of approaching laboratory results, but Big Four officers felt that the moral effect of making the tests would aid in obtaining better concrete, and that the possibilities of improving the quality of concrete warranted a trial of these methods. Moreover, this trial would determine the practicability of adopting these methods on future work.

It was decided to use a mix which should theoretically produce a concrete of the following compressive strengths at an age of 28 days:

Footings	2,000 lb. per sq. in.
Piers and abutments	2,500 lb. per sq. in.
Spandrel arches	2,500 lb. per sq. in.
Arch rings	3,000 lb. per sq. in.

In the footings, piers and abutments, a pre-mixed gravel aggregate was used, but because the results were not considered satisfactory, separate fine and coarse aggregates were used on the remainder of the work.

For the arch rings and spandrel walls, sand 0 to ¼ in. and crushed boulders and pebbles ⅜ in. to ½ in. in size were used. The fineness modulus of the fine and coarse aggregates was quite uniform, averaging 3.2 to 7.8, respectively. For the arch rings, the batches generally consisted of 11 cu. ft. of sand and 17 cu. ft. of stone, which, when mixed, had a fineness modulus of 5.95. For the superstructure, 12 cu. ft. of sand and 16 cu. ft. of stone were used in each batch, the mixtures having a fineness modulus of 5.8.

In the concrete made from separate aggregates, the slump was usually limited to 4 in., many batches having a slump of only 1 or 2 in., the average being about 3¼ in. This produced a concrete much drier than it was thought could be handled through the chutes, but no difficulty was encountered. There has been considerable general condemnation of the tower and chute as a means of distributing concrete, because of the tendency to use very wet mixtures, which often result in a separation of the mortar and stone. On this work, however, the concrete was successfully placed by chutes, and it is stated that this was accomplished without requiring the use of excess mixing water and with practically no separation of materials. The slope of the chutes varied from 1 on 2 to 1 on 3.

Standard 6-in. by 12-in. test cylinders were made in accordance with the A.S.T.M. Standard (Serial C-31-31), except that instead of taking the sample from the form, it was drawn directly from the discharge of the mixer, so that the actual slump of the sampled batch could be measured. From three to six specimens were made for each day's run, from different batches, and were stored in wet sand. Tests were made at 28 days. Two hundred and eighty specimens, representing various mixes and slumps ranging from two to eight inches, had been broken up to December, 1923, and several hundred more tests will be made before the completion of the work. A brief summary of the results of tests of specimens made at the arch bridge between April 10 and November 11 is as follows:

True Mix	Fineness Modulus	No. of Tests	Expected Strength	Actual Strength	Slump Test
1 to 4.55	5.90	52	2,600	2,418	2" to 4¼"
1 to 4.09	5.90	14	2,900	2,886	2" to 4¼"
1 to 4.05	5.80	22	3,000	2,810	2" to 2¾"
1 to 3.68	5.80	28	3,016	3,372	2" to 5¼"
1 to 3.66	5.70	20	2,834	3,403	3" to 5¼"
1 to 3.38	5.85	48	3,281	3,199	2" to 3¼"
1 to 3.12	5.85	35	3,361	3,699	2" to 5¼"
1 to 2.36	6.0	4	2,840	2,203	6" to 8"

The column designated as the "True Mix" indicates the ratio between the volume of cement and the volume of the combined aggregates when dried and rodded in accordance with A.S.T.M. specification. This ratio is used in order to obtain direct comparisons of the net volumes of materials used in each test, and thereby eliminate the necessity of making any allowance for variance in volume due to the moisture content of the materials as used in the field. The shrinkage of the two loose aggregates thus obtained averaged 25 to 30 per cent, or approximately the total shrinkage of the finished concrete. For the purpose of comparison, the relative ratio of cement to aggregates in the 1-2-4 mix as usually expressed may be compared with a true mix of about 1-4-3, as indicated in Table 1, the volume of the separated aggregates averaging about a third greater than the combined aggregates when dried and rodded.

In an article published in Engineering News Record of October 11, 1923, J. B. Hunley, Bridge Engineer, presented the following conclusions regarding the value of these methods:

"1. That the method of designing concrete mixtures, as worked out in the laboratory, is applicable under field conditions and that a concrete of predetermined strength can be obtained with considerable accuracy, by using the proper mix and consistency.

"2. That quite dry concrete, of aggregates properly proportioned, can be worked without difficulty and handled by the usual methods, and with considerable saving in cement over that necessary in the wetter mixtures of equal strength.

"3. That a specification, simply defining the mix as 1-2-4 and 1-3-6, etc., without establishing some further requirements as to the consistency and grading of the aggregates, means little from the standpoint of strength, as the results

may vary 100 per cent, and consequently such a specification is uneconomical.

"4. That better results can usually be obtained with concrete made from separate aggregate (sand and stone) than from a premixed aggregate (gravel).

"5. That unless inspectors who are familiar with this method of proportioning concrete are available, it is scarcely practicable on small work, as it takes them some little time to learn the mechanics of the tests, and longer to completely grasp the theory, so as to be able to intelligently vary the mix under the different conditions of weather, material and pouring. Where frequent sieve analyses and slump tests are made, it requires a good deal of the inspector's time and on large and important work a special man to make the necessary tests would probably be justified."

New York Central Lines—West

The New York Central Lines West has fitted up a laboratory in its general office building at Cleveland, Ohio, for making tests on concrete.

Standard 6x12-inch concrete test cylinders are made on each job, inexpensive tin molds being used for the purpose. Specimens are shipped in the tin containers to the shops at Collinwood, where large testing machines are available for making the actual tests. The tin containers are stripped from the cylinder just before the test. Each container is thus used but once.

Slump tests are made frequently on all concrete work and every effort is put forth to limit the slump to 6 in. for reinforced work, 2½ in. for mass work, and where the work permits, a smaller amount. Inspectors are equipped with slump test cones, a supply of the tin molds, and a set of sieves for making analyses of the grading of aggregates.

In the last year sieve analyses have been made of the greater part of the aggregates commonly used for concrete work at different points along the line. In addition, test cylinders have been made from all of these aggregates in order to determine their relative value for use in concrete. As a result of these tests, it is possible to select aggregates much more intelligently and to use the best available local materials on each job. Humus (colorimetric) tests are also being made on all sands, both in the laboratory and in the field.

This laboratory has been gradually developed during the last five years, so that inspectors, contractors and material dealers are familiar with its work and value, and are able to co-operate in obtaining increasingly higher standards in concrete. This work is being done under the direction of B. R. Leffler, bridge engineer, and F. K. Deinboll, chief material and supply inspector.

Newark Bay Bridge

The Central Railroad Company of New Jersey has recently started the construction of a four-track deck plate girder bridge about 7,100 ft. long across Newark Bay between Elizabethport and Bayonne, N. J. The bridge will require about 100,000 cu. yd. of concrete, 35,000 tons of steeel, 13,000 piling and 650 cu. yd. of dredging. In addition the land approaches will require approximately 10,000 tons of steel and 15,000 cu. yd. of concrete.

All concrete is being designed to have a strength of 3,000 lb. per sq. in. at the age of 28 days. The aggregates are proportioned as to give a combined fineness modulus of 5.7 and the consistency is limited by a maximum slump of three inches, except in case of concrete used around reinforcement, where four inches is permitted.

Extensive tests are being carried out on this work and the results so far obtained from a number of standard 6 in. by 12 in. cylinder tests show that the actual strengths obtained are somewhat higher than the estimated strength. This work is being done under the direction of A. E. Owen, chief engineer, and under the jurisdiction of J. J. Yates, bridge engineer.

Researches on Concrete Now Under Way

Among the important investigations under way is an extensive study being made at the Structural Materials Research Laboratory of the use of concrete in alkali soils and a long series of tests on several hundred fine and coarse aggregates obtained from all parts of the United States. Several hundred specimens of concrete made of different aggregates, with different mixes, consistencies and conditions of curing, and in some of which various water-proofing and alkali-proofing compounds had been added, were installed at Medicine Lake, S. D., and at Montrose, Colo., in November, 1921. The test specimens were 10 in. in diameter and 24 in. long and were placed on end in such manner that they were embedded about half way in alkali soil or water. The alkali conditions at Montrose, Colo., are probably the most severe of any point in North America, and the specimens are continuously exposed to a saturated solution of sodium sulphate. At Medicine Lake the specimens are constantly in contact with water containing about five per cent magnesium sulphate. These extensive alkali tests, which are more comprehensive than the above outline indicates, may throw valuable light on the use of concrete in sea water.

Discussion

(C. C. Westfall (chairman) submitted Appendix A, revision of the Manual and *his motion that it be adopted was carried*. He then introduced T. L. Condron, a member of the sub-committee on Principles of Design (Appendix B), who explained the chart of proposed culvert design loadings.)

E. A. Frink (S. A. L.): I have only one criticism to make of the diagram. I think it is too conservative. My own practice has been to use a slope of one to one. It seems to me that all parts of the fill wherever they are confined by material outside of the line of pressure will probably take an equal distribution of the live load. I think the committee is working along exactly the right lines in its formula for impact. The impact is a function of the amount of dead load, but in that point also I think the committee is very conservative.

C. A. Morse (C. R. I. & P.): I would like to ask the committee if it is considering the weight while the embankment is settling, or whether it is making any difference between conditions at that time and after the embankment has settled. I ask that question for the reason that a number of years ago our cast iron pipes were crushed while the bank was settling. Our chief engineer put out a rule that in banks over 25 ft. in height we should put some vertical braces in these pipes and keep them in for about three years while the bank was settling, then we took the braces out and we never had a case of crushed pipe.

B. R. Leffler (N. Y. C.): Mr. Morse called attention to possible arch effects of the fill as affecting the load on top of the culvert. I know that that idea has been held by engineers, but I often ask myself the question, why does nature make the pressure per square foot on top of the culvert box any less than on the outside of the box? I never could quite see the logic back of that statement. I am inclined to think that the box is loaded clear up to the top of the fill just the same as the ground on the inside of the box.

I. L. Simmons (C. R. I. & P.): I never have been fully satisfied yet that when that arch effect took place the ends of the arch weren't going to be right in the center of the span, and in that case increase the load considerably.

W. L. Foster (Iowa State Col.): I wonder if the committee has had access to the mass of information that has been developed under the Iowa Engineering department?

Chairman Westfall: Two of the members of the Masonry committee belong to the Committee on Concrete Pipe Investigations. In that way it has been keeping in touch with those experiments.

Professor A. N. Talbot (U. of I.): Reference has been made to the work of the Committee on Stresses in Track attempting to find the distribution of pressure downward through granular material, such as ballast. As has been stated here, that distribution is uneven. We expected that that would be the case. It is not a uniform pressure as engineers have ordinarily considered. However, my impression is that the results obtained by dividing the full load applied by the distance across the base as the committee has done gives about the maximum of pressures throughout the great middle portion. I feel sure that the committee is not too conservative.

Now with respect to arch action—the material in the fill is elastic to a certain extent and will compress on either side of the culvert, consequently there will be a greater load on the culvert than you would expect from any of these other considerations. It seems to me that the method of putting in the fill or putting the culvert into the fill, whichever way it is done, will modify greatly the pressures which come upon it.

Dean A. M. Marston (Iowa State Col.): Our work on culvert loadings has been under way for several years and we do find that phenomena mentioned by Prof. Talbot, that when the culvert projects up into the mass of an embankment made of compressive material, then through the greater settlement of the material adjacent to the culvert, the culvert is forced to carry a load greater than the total weight of the material above the culvert.

We find that the live load is transmitted from the surface down through the embankment with a rather rapid spread. The results in our impact work are not in very definite shape to report at the present time, except this, that the effect is very violent upon a culvert only two feet below the surface, but as the height of fill increases the cushioning effect increases very rapidly.

Mr. Leffler: I want to ask Prof. Marston if there is a release of excessive overload as the fill seasons or comes over.

Dean Marston: We made observations extending for an entire season and in that period of time there was no extensive release of the load. We find the weight of embankment is always greater than 100 lb. per cu. ft. To be safe you had better take 125 lb. per cu. ft.

C. F. Loweth (C. M. & St. P.): I have seen a great many culverts in which I was assured that the filling arched over the culvert. I was also assured before I got through with my investigation that in such cases almost invariably it was due to a yielding of the foundation of the culvert. I think that a great many broken culverts are explained by the fact that the foundation has been too rigid, that the culvert could not settle in the same degree as the material in the embankment or in the natural ground on either side settles.

(The report of the sub-committee was received as information, following which Chairman Westfall introduced C. P. Richardson (C. R. I. & P.), chairman of the sub-committee on Developments in the Art of Making Concrete (Appendix C), who presented the report. It was received as information and the committee was excused with the thanks of the association.)

Report on Records and Accounts

The Committee on Records and Accounts presented as information a detailed report on cost keeping methods and statistical records, outlining the procedure which must be followed to secure unit costs for individual items of work as, for instance, the renewal of ties. The report also contained a large number of suggested forms for use in segregating this information and presenting it in a manner that would facilitate the analysis of the figures and the intelligent compilation of the data. While all of the forms bear a close relation to the control of expenditures, two forms representing the practice of two roads have been submitted and discussed in considerable detail. H. M. Stout is completing his fourth year as chairman and his tenth year as a member of the Committee on Records and Accounts.

H. M. Stout
Chairman

THE COMMITTEE presented a report on the revision of the Manual in Appendix A and on cost-keeping methods and statistical records in Appendix B. This latter is a combination of the two subjects: (a) Cost-keeping methods and statistical records, and, (b) forms for analyzing expenditures for assistance in controlling expenditures.

No report was presented on the plans, methods and forms for gathering and recording data for keeping up to date the physical and valuation records of the property of railways; and on the feasibility of reducing the number of forms used in the engineering and maintenance of way departments, combining forms and simplifying those retained. A detailed progress report was also submitted by the committee on the revision of Interstate Commerce Commission's classification of accounts in Appendix C and in a supplement to this appendix published in a separate bulletin of 134 pages.

The committee recommended the following action on its report:

1. That the changes in the Manual presented in Appendix A be approved and the corrections and substitutions there recommended be made in the Manual.
2. That the presentation and discussion in Appendix B be received as information and as a progress report.
3. That the matter relative to the revision of the

classifications of accounts of the Interstate Commerce Commission be received as information.

Committee: H. M. Stout (N. P.), chairman; R. A. Cook (C. & A.), vice-chairman; E. F. Ballard (M. K. T.), A. M. Blanchard (G. T.), W. A. Brewer (C. & N. W.), H. Bortin (Con. Engr.), H. A. Campbell, Armstrong Chinn (C. B. & Q.), A. C. Copland (C. & O.), H. C. Crowell (Penna.), E. B. Craine (C. M. & St. P.), C. C. Haire (I. C.), W. C. Harvey (C. G. W.), Henry Lehn (N. Y. C.), H. T. Livingston (C. R. I. & P.), L. P. Rossiter (L. V.), H. J. Sargent (Wab.), H. F. Sharpley (C. of. Ga.), C. W. Simpson (D. L. & W.), W. A. Van Hook (Civ. Engr.), V. R. Walling (C. & W. I.), G. R. Walsh (M. P.), W. D. Wiggins (Penna).

Appendix A—Revision of the Manual

The following revisions of the Manual of 1921 are recommended:

1. Instructions for Use of Form 1113.

(a) Page 514, the second from the last paragraph:

Present Form	Proposed Form
The authority should be made to expire at the end of the year in which issued. If work is incomplete at that time, a new authority should be issued for the following year's expenditures.	Program authorities should expire at the end of the period for which they are granted.

(b) Page 515. The last paragraph, beginning "Estimates should be numbered. . . . . ," including the seven numbered items thereof, should be eliminated. These specifications pertain to the Estimates, not to the Authorities for Expenditure. And these instructions are given on the following page, in the appropriate place, under Instructions for Use of Form 1114.

2. References to Government Operation of Railroads.

Sufficient time has elapsed since the end of Federal operation and of Federal control that all provisions for references to government records should be eliminated from forms and specifications. The following corrections, therefore, should be made:

Page 517, Form 1115.—Eliminate columns 4 and 5 (D. C. E.—Form and No.).

Page 519, Form 1117.—Eliminate line 3 on the right, and line 4 on the left of the heading ("D. C. E. Reference" and "Under Government Operation," respectively).

Page 520, Form 1117A.—The same correction as on Form 1117.

Page 521, Form 1117B.—Eliminate line 2 on the left of the heading ("D. C. E. Reference").

Page 522, Form 1117C.—The same correction as on Form 1117B.

3. Specifications for Maps, Charts and Profiles.

(a) Station Maps. Page 535.

Eliminate the ninth or last paragraph reading: "Tracks shall be represented on station maps either by center lines or by rail lines."

(b) Profiles; (c) Quantities. Page 538.

The first paragraph should be revised as follows:

Present Form	Proposed Form
Profiles of railways built after February 1, 1914, shall show for each mile a summary of construction quantities to sub-grade, including roadways, bridges, and culverts. Profile of railways built before February 1, 1914, may show, at the option of the company, similar quantities in the same summary form.	Profiles shall show for each mile a summary of construction quantities to sub-grade, including roadway, bridges and culverts.

Appendix B—Cost-Keeping Methods and Statistical Records

It is believed that the fundamentals for this purpose are few and simple and consist of a record of all the units of material used and their costs, with all the costs for applying such material to a definite location with proper credits, if any, for material salvaged.

If an analysis of the accounting for a certain class of work under study shows that this information is not readily available, then the cost per unit cannot be ascertained until the accounting is made to fit the requirements.

Cost of Renewing Cross-Ties and Rail

From the classification of operating expenses, as prescribed by the Interstate Commerce Commission, the material cost of cross-ties and rail is charged to accounts No. 212 and 214. The labor and work train service costs of unloading, distributing and putting ties and rail in track, and the cost of picking up and disposing of released materials are charged to account No. 220, along with many other items of expense pertaining to track maintenance. Therefore, in order to obtain unit costs of this work, the costs must be segregated at the source and compiled for totals in the roadmaster's, engineer's, superintendent's or accountant's offices, as the individual road may elect. With this information then available, the cost per tie may be determined. The cost of renewing switch ties and bridge ties may be obtained in like manner. The accounting for rail is similar to that for ties, although complicated by account No. 216—other track material. To obtain cost per unit, the costs must be segregated and compiled as indicated in the cost of renewing cross ties.

Cost of Painting Bridges per Ton of Steel and per Square Foot of Surface Area

The main item of Cost of Maintaining Steel Bridges is cost of painting. In order to ascertain cost of painting per ton and square foot of steel the costs must be segregated and compiled as outlined.

This form is designed to be used for individual bridges, but with slight modifications it may be used for all bridges of a type, or for all bridges of a division or system. Similar forms may be prepared to record cost of painting buildings.

Cost of Maintaining and Operating Coaling Stations

The form submitted is intended to give comparative data upon the cost of maintenance and of operation of coaling stations. While criticised in the committee because of the inclusion of cost of operation, it appears that there are roads where the management of operation as well as of maintenance rests in the engineering department, and also where it is an engineering duty to investigate cost of operation and to assist in the selection of the proper type of station. The form is designed to bring out the relative costs and efficiency by years and by types of plant. The cost of maintaining and operating water stations, cinder pits, etc., may be obtained in like manner.

Statistical Records

Cost-keeping is used to ascertain cost of work done, but such records of cost are of value not only for a particular period and location, but may be used to greater advantage to make comparison of costs, one period with another or one location with another.

The number of cross-ties renewed, tons of rail laid, number of trackmen hours worked, etc., for a given period are of interest and value as a record, but their real value is had, as with costs, when the record of such statistics is shown in comparison with performances of other periods. Some additional typical forms for record-

ing such statistics were presented by the committee covering the following subjects: Hourly rates of pay of trackmen; average cost of ties and rail; comparison of tie renewals; rail in track and rail renewals; graphical comparison of hours of labor worked; and graphical comparison of expenditures.

Forms for Controlling Expenditures

Cost-keeping, statistical records and the control of expenditures are so closely interwoven that while the Exhibits Nos. 1 to 15, inclusive, are to be used for the purposes named under the subjects of cost-keeping and statistical records, they have such a close relation to this matter that if the information is kept as outlined it will assist in the study and handling of this larger subject. The committee was not able to secure or prepare a comprehensive list of forms for this report. Two forms were submitted which have been in use on two roads for some time and have proven to be of assistance for the purpose for which they were prepared.

Estimated Expenditures of Maintenance of Way and Structures for Current Month of Current Year Compared with the Same Month of the Three Previous Years

Estimate is prepared by Interstate Commerce Commission Accounts and compared with the actual expenditures for the three previous years, as shown on the form. The management may restrict the proposed expenditures to a certain sum, to the average expenditures of the last three years or to last year's expenditures. If the estimate exceeds the allowance, reductions are made in those accounts where the work is the least urgent. When the actual expenditures for the month estimated have been received they are entered on the form for checking accuracy of the estimate with the actual and for assistance in preparing next month's estimate. Totals for period to date furnish a check on actual and estimated expenditures of the current year.

Estimated Expenditures of Maintenance of Way and Structures for Current Month of Current Year

This is a very comprehensive form providing for estimate to be segregated between labor and material. On the particular road where it is used it is handled in the following general manner:

Maintenance of way is centralized in the superintendent of the division. The accounts are compiled in the superintendent's office, showing the total amount spent under each item, and sent to the auditor of disbursements' office.

The general plan of dealing with expense of the maintenance of way department is that the engineer, after conferring with the supervisors, prepares and submits to the superintendent a statement on this exhibit, on which is shown the force to be worked the coming month, by supervisor's districts, and on the same form is shown the force worked in the corresponding month of the preceding year. Under the title of expense is shown, by accounting items, the estimated total expenditures, including both labor and material; also such portions of expense which may be chargeable to additions and betterments, and this likewise is compared with the same period of the previous year. This statement is accompanied by a very full and complete detail showing the general plan to be followed during the succeeding month. Quantities and values of various kinds of material to be used are included on this detailed statement, and this information, after being approved by the superintendent, is furnished in triplicate through the general superintendent's office, to the engineer maintenance of way on the 20th of the month. The engineer maintenance of way then prepares his recommendations and submits them to the general manager on the 24th of the month for authorization.

As soon as the engineer maintenance of way has been advised what he will be permitted to expend in this particular month, a conference is held at the office of the engineer maintenance of way, which meeting is attended by the general superintendent and district engineer of the grand district, and all of the superintendents and engineers within such grand district, at which time a general discussion is conducted in which division officers are encouraged to express freely their views and recommendations covering the work at hand. At this meeting, the engineer maintenance of way and general superintendent decide upon the expenses, which, in their judgment, are necessary and advisable. In case all the expenditure requested has not been authorized, the amount of money to be spent is redistributed between the bridge, building, track, water service and other departments, where most needed.

The monthly allotment decided upon is given the division officers at this expense conference, and the superintendent and engineers on reaching their headquarters, call a conference of their supervisors. The expenditure is divided in an equitable manner, each supervisor being given a definite allowance of men and material covering the 30-day period.

The supervisors in turn advise their respective foremen of their allotment of men and material for the month, and in order to regulate the appropriation, the foremen daily furnish their supervisors with a statement of the amount of force and material used on the work under their jurisdiction. The supervisors consolidate these reports and forward them to the engineer, with the result that the division officers have immediate knowledge of total expenditures to date.

When extraordinary conditions arise during the month, such as washouts, wrecks, snow storms, and the like, the practice is to have the division superintendents, through their general superintendent, advise the engineer maintenance of way just how much additional allotment is required. If this extraordinary expense is found extensive, the engineer maintenance of way orders retrenchments on various divisions of the system in order to offset the extraordinary charges.

After the accounts are closed for the month, the engineer prepares a statement on this exhibit showing the actual expenses and the allotment figures, together with a detailed explanation of the increases and decreases in each account.

Discussion

H. M. Stout (chairman) presented the report and introduced A. C. Copeland, chairman of the sub-committee on Revision of the Manual, who in turn presented this portion of the report.)

E. J. Correll (B. & O.): The present revised paragraph provides that "program authorities should expire at the end of the period for which they are granted." That would imply there is only one kind of authority. Now, we have a budget authority which expires at the close of the year and a capital expenditure authority which closes with the work. I would like to suggest to the committee that it re-word that proposed form and substitute "program maintenance authorities will expire at the close of the year; capital expenditures will expire with the completion of the work and the closing of accounts."

President Lee: The committee will edit the particu-

lar clause so it will meet the objections that have been raised.

(*A motion to adopt the revision in the Manual was carried.*)

(V. R. Walling (C. & W. I.) presented the matter covered by Appendix B and it was received as information. Chairman Stout then presented the report on the Revision of the Interstate Commerce Classification of Accounts.)

President Lee: The report of this committee is submitted as a report of progress, and by way of information to this association. The matter is of great importance and it deserves very careful thought and very careful study by the members of this association. I want to compliment the committee and the chairman of the committee on the way in which they have handled a very difficult subject.

(The committee was excused with the thanks of the association.)

Report on Wood Preservation

The greatly increased interest in timber preservation in recent years has brought about an increased demand for creosote in the face of a decrease in the available supply, accompanied by changes in quality. This has resulted in a desire on the part of some to change the A. R. E. A. specifications to allow creosote of lower specific gravity. The Committee on Wood Preservation, taking into consideration all the information available on the subject, has recommended that no changes be made in the A. R. E. A. specifications at this time. The committee presented reports on the service life of ties, on the use and results of creosote mixed with other oils and on marine piling. S. D. Cooper is completing his first year as chairman and his third year as a member of the committee.

S. D. Cooper
Chairman

THE COMMITTEE presented no revisions to the Manual but submitted an analysis of the creosote situation in Appendix A, with the recommendation that no changes be made in the existing specifications for creosote. It also submitted the usual report on service records of ties with conclusions relating to the value of various forms of treatment in an Appendix B. In an Appendix C, on marine piling investigations, the committee presented as information a preliminary and partial report of work of the Committee on Marine Piling Investigations of the National Research Council. A report on the preservative treatment of signal trunking and capping was submitted in an Appendix D. In an Appendix E, the committee reported in considerable detail upon the use and results of creosote mixed with other oils. All of the reports were submitted as information.

Committee: S. D. Cooper (A. T. & S. F.), Chairman; H. N. Rodenbaugh (F. E. C.), Vice-Chairman; Wm. G. Atwood (Nat. Research Council), R. S. Belcher (A. T. & S. F.), E. H. Bowser (I. C.), Z. M. Briggs (Penna.), J. R. W. Davis (G. N.), C. F. Ford (C. R. I. & P.), J. H. Gibboney (N. & W.), Andrew Gibson (N. P.), C. E. Gosline (D. L. & W.), R. H. Howard (Wab.), G. H. Hicks (N. P.), W. H. Kirkbride (S. P.), E. E. King (Univ. of Ill.), J. B. McClain (S. A. L.), J. F. Pinson (C. M. & St. P.), B. H. Prater (O. S. L.), Frank Ringer (M. K. T.), H. von Schrenk (Con. Timber Engr.), F. C. Shepherd (B. & M.), O. C. Steinmayer (St. L.-S. F.), J. H. Waterman (C. B. & Q.), J. W. Williams (W. P.)

Appendix A—Revision of the Manual

During the war period and ever since the war there has been considerable discussion in reference to the standard specifications for creosote. Reference to this matter was made by the committee in 1922, at which time the committee recommended paying increasing attention to the tars from which creosote was produced. During the past year the committee on revision of the manual has spent a great deal of time in investigating the creosote situation. As is well known, our creosote is obtained from domestic sources and from abroad. With the increasing interest in timber preservation there is naturally an increased demand for creosote. Unfortunately instead of an increased quantity being available there has been less creosote available than at any time before the war. The domestic supply is not what it could be, because of the fact that so much of the tar produced in coke ovens still serves for fuel, with a consequent reduction in the creosote quantity. The European supply has been reduced due to post-war conditions and is still far from normal. Not only has the quantity of creosote available been reduced, but there have been certain changes in the quality, reference to which was made in the committee's report two years ago. A great deal of creosote is being received from domestic as well as foreign sources which will not comply with the present A.R.E.A. specifications. This refers particularly to the specific gravity of the creosote as a whole and to the specific gravity of the fractions, all of which in many of the creosotes offered fall below the present A.R.E.A. specification standard.

Recognizing the fact that many of these creosotes do not conform to the standard, strong pressure has been brought to bear to have the A.R.E.A. revise its specifications, to the extent of allowing creosotes of lower specific gravity than is permitted by the present standard.

The committee has given careful study to this question and in connection therewith has consulted not only users, but also producers of creosote, importers thereof, coke oven experts and others familiar with the tar industry. The subject is a very complex one, because it involves a thorough understanding of the processes of tar production as well as the fitness of the creosote produced from various tars for timber preservation. It

should be remembered that the present A.R.E.A. specification standards were written after exhaustive studies of creosotes, generally in European countries, which had shown from actual service in the track that 30 years' life or more could confidently be expected from their use. The A.R.E.A. specifications were written and patterned largely after the standards of England, Germany, France and other European nations.

Creosotes of the character prescribed by the A.R.E.A. specifications had stood the test of time and could confidently be expected to give similar results in the United States. As indicated by the committee two years ago, comparatively recent development of gas and coke production has resulted in the production of tars which, when distilled, produced creosotes different from those hitherto well known. This was particularly true of tars from so-called vertical gas retorts and from low temperature coking operations, and the creosotes distilled from such tars differ from those produced in high temperature ovens in that they contain varying percentages of paraffin bodies. They are also characterized by low specific gravities (some recent shipments had specific gravities as low as 1.016 at 100 deg. F.) with correspondingly low gravities of the two fractions prescribed by the A.R.E.A. specifications. Little is known of these comparatively new types of creosote. While the specific gravities are low, there is no definite information available as to the comparative rate of evaporation from timber compared with the creosotes of higher specific gravity, and practically nothing is known as to their comparative preservative value.

The committee has endeavored to ascertain how much of these new type creosotes may reasonably be expected both from this country and abroad. As the result of these investigations the committee is of the opinion that while certain quantities of these low temperature tars will undoubtedly be produced in the immediate future, there is no indication that they will entirely or partially supplant the high temperature tars of the past. In fact, the committee has gained the impression that the development of the modern coke oven industry is rather along the lines of the high temperature coke oven type, with the resultant production of high specific gravity tars, and high specific gravity creosotes. This appears not only to be true for the United States, but also for England and France. In this connection the committee printed as information specifications for creosote recently adopted by the British Engineering Standards Association; specification for creosote recently adopted by the German government railways, and specifications for creosote recently adopted by the French railways. It will be noted that in all these European specifications the specific gravity of the creosote itself has been materially reduced. The specifications in other respects have been radically changed from those in existence prior to the war. Inquiries asking for specific reasons for these changes have invariably been met with polite replies that the proceedings leading up to the adoption of these specifications were strictly confidential and could not be furnished. The interpretation placed by the committee on these changes in European specifications is that the European railroads, coal people and tar distillers (all of whom we find were jointly instrumental in the development of these new specifications), adopted these specifications not on the basis of technical efficiency, but more or less as a commercial compromise. At least no information has been available to the committee, both from correspondence as well as numerous personal conferences with persons high in authority, both from England and the continent, which would permit of any other interpretation.

Taking all of these matters into consideration, the committee is of the opinion that this is no time to change the present A.R.E.A. standards. Certain quantities of creosotes not conforming to these standards will undoubtedly be available, but it is also true that large quantities are also available which do comply with these standards and the outlook for the future clearly indicates that the quantity which fulfils the standard will be more likely to increase than decrease. This recommendation of the committee is strongly endorsed by the leading creosote importers from abroad, who are unanimous in their expressions that a lowering of the present A.R.E.A. standards would be a step backward and should be avoided.

The acceptance or rejection of creosotes which do not conform to the present A.R.E.A. standards will have to be made the subject of individual determination, and the caution is again expressed as given two years ago, that a study of the tars from which creosotes are produced will be very essential.

Conclusion

The conclusion which the committee has come to is, therefore, that the situation should be still regarded as in a state of development and that no changes in the present A.R.E.A. specifications for coal tar creosote should be made at this time.

Appendix B—Service Test Records

In order to avoid printing lengthy tabulations from year to year, the committee determined to print each year only such test records as involve 50 ties or more, and also only those records in which 100 per cent of the test ties had been removed from the track.

About 1904 and 1905 a number of test sections were put in with the modern viewpoint, and since that time there are, conservatively stated, several hundred of such sections covering many thousands of ties. These test sections include different kinds of wood, different sizes of ties, and different treatments, and in many cases different types of ballast, rail fastenings and tie plates. The test sections also are arranged on many railways to take care of varying climatic conditions.

In the early days the test sections were laid largely for the purpose of obtaining figures as to the comparative life of treated vs. untreated ties, because in those days tie treatment was regarded as more or less on trial. As will be indicated in the conclusions, this is no longer to be questioned. The great value of maintaining test sections at the present time is that by keeping accurate records on the test sections, and in that way alone, can the necessary information be obtained with reference to the life of different kinds of timber, different methods of preservation and incidentally the influence of such accessory factors as traffic, fastenings, ballast, etc. The manner in which test records are now being kept on the principal railways assures the most detailed information with reference to the kind of material treated, the treatment and subsequent use. Careful annual inspections record the exact conditions from year to year. In its last year's report the Committee called attention to the fact that many railways failed to report their service records, and we wish to again emphasize the necessity for regular and accurate annual reports, because in that way alone will it be possible to draw reliable conclusions in the future as to the relative value of different preservatives and different types of ties.

The committee has hitherto refrained from presenting any definite conclusions with respect to different types of treatment. This has largely been because the complete records were available only from test sections

established many years ago, when much of the necessary data was omitted. A careful study of the tables so far published shows many apparent variations in life, some of which are readily explained, because of different climatic, traffic and other conditions. It probably will not be possible for some years to come to give a definite answer as to the exact length of life which may be expected in various sections of the country, under varying traffic conditions, for each kind of wood or each kind of treatment. Creosoted ties have only been in use some 18 yr., and none of those laid have as yet even approached an average life.

Notwithstanding the incomplete state of the available data, the committee felt that certain fundamental conclusions might be drawn, which are herewith briefly outlined:

(1) Value of Treatment—The use of treated ties of one kind or another is not only an economic necessity but an economic duty for all railways. In other words, nothing but treated ties should be laid, irrespective of climate, or any other conditions. The only exception to be taken is in the case of such railways as still have available naturally long-lived woods, such as redwood, tidewater cypress, cedar or other woods of equally known long natural life.

(2) Comparative Value of Treatment—A study of the complete test records published to date, together with the data obtained from railways as a whole, indicates that definite figures as to length of life from different treatments cannot yet be given. This will readily be understood when it is remembered that one has to deal with woods of different degrees of hardness, with varying climatic conditions, and physical conditions of the track. The following, however, may be taken as a safe guide:

(*a*) *Zinc Chloride Treatment*—In its report of 1919 the committee submitted the conclusion that one can unquestionably figure on doubling the life of the most inferior untreated timber by treating the same with zinc chloride, and in dry climates this life will undoubtedly be extended. The committee at this time adhered to this conclusion, and, in addition, believed that a conservative estimate will place the life of ties treated with zinc chloride at from 6 to 15 years. The exact life will be somewhere within these limits, depending upon climatic conditions under which this type of treatment is used, and the kind of timber treated.

(*b*) *Zinc Creosote*—Depending upon climatic conditions, a probable length of life of ties treated with this process may be placed at from 8 to 18 years.

(*c*) *Empty-Cell Creosote Processes*—Ties treated by the empty-cell creosote processes have not been in track long enough as yet to give even a tentative figure. Attention is called to the fact, however, that in the most extensive experimental track laid in eastern Kansas in 1906, with pine ties treated with one of these processes, 96.2 per cent are still in track after a serice of 17 years. On another railway, hardwood ties treated with another empty-cell process, 89 per cent of ties laid in 1905 are still in track. From records of this sort, it appears to be a safe conclusion that when properly treated, a life of 16 years will positively be obtained, with the chance that this will run up to 25 years or more under proper maintenance conditions.

(*d*) *Full-Cell Creosote Treatment*—Only a small number of full-cell creosoted ties are now in service. On some of the test sections, treated ties have been removed, but in practically every case the removal has been due to mechanical factors. It is generally recognized that the full-cell creosote process is not warranted at the present time, because mechanical life under present conditions will always be very much shorter than the life to be expected from decay protection given by full-cell treatment.

(3) Choice of Treatment—From the foregoing it is evident that the various processes may reasonably be expected to give different lengths of life, always remembering that this will be materially affected by conditions of service rather than the treatment. The choice of the proper treatment to be used by any railway is to be regarded largely as an investment question. In other words, the choice of treatment should in its first analysis consist in comparing the life which is being obtained from ties in actual use, and determining the annual charge against such ties, and then comparing this with the annual charge from ties treated by various methods. For example, if an untreated tie costs $1.00, and has, as shown by experience, four years' life, roughly figuring, the annual charge against such a tie is 25 cents. If such a tie be treated at a cost of 25 cents, one would have to obtain five years of life in order to have the same annual charge. (For the sake of simplicity such factors as interest, etc., have been omitted.) If there is reasonable assurance that five years of life will be obtained from that particular preservative treatment, any life beyond five years will be that much gain. Having arrived at the conclusion as to the amount of money which will make the annual charge equal or better in the case of preserved ties, the choice will then naturally depend upon the availability of any particular preservative.

Conclusions

(1) Only treated ties should be used for permanent track construction, with the exception of the few durable woods noted above.

(2) Varying lengths of life may reasonably be expected for various types of treatment—zinc chloride, zinc creosote, empty-cell creosote, and full-cell creosote.

(3) The choice of which treatment should be selected should be considered as a problem of risk in investment as shown by probable annual charges.

Discussion

(The report was introduced by S. D. Cooper (chairman) and the sub-committee reports presented by the chairmen of the sub-committees. Dr. H. Von Schrenk (consulting timber engineer) outlined the work on the revision of the Manual given in Appendix A. No action was taken by the Association regarding changes in the specification for creosote. C. F. Ford (C. R. I. & P.) presented the report on service test records. Following the reading of this report, Dr. Von Schrenk presented and described a number of charts which he had prepared on the life of untreated ties. The charts were based on actual records of individual ties over a long period on the New York Central and the Kansas City Southern. Following this presentation, the chair asked if there were any questions on the subject.)

Hunter McDonald (N. C. & St. L.): I have recently been requested to show the real value of adzing and boring, but couldn't find any conclusive evidence that adzing and boring pay. Of course, we all recognize the value of adzing, but it seems to me that if we could get some record of why the treated tie was removed it would be of considerable value to us. At present the records seem to show merely when the life expires.

Chairman Cooper: The use of the adzing and boring machines has not been followed long enough to compile that information, but we do get several advantages from this practice. In addition to the adzing for the tie plate, we bore the hole for the spike and get the extra treatment in the tie at the point where it gets the most wear. In addition to that, there is a cutoff saw which enables us at times to take ties that would not pass the inspector otherwise.

(Dr. Von Schrenk then briefly reviewed the work of the National Marine Piling Committee. He was followed by W. H. Kirkbride (S. P.), who related the circumstances which gave rise to the formation of this committee and offered certain conclusions which were in part as follows:)

Mr. Kirkbride: It may be of interest to say that the judgment displayed by the people who had to use creosoted piling in the rebuilding of structures destroyed by borers in San Francisco bay has been justified by the work of this committee.

There is another problem that has attracted considerable attention. The statement has been made that the so-called Pholus works in concrete. We all know that Pholus does work in sandstone, and the speaker has seen Pholus in so-called concrete, but the concrete was not concrete in the sense that we speak of it. It is reasonable

to suppose that the Pholus would have no more trouble in penetrating such material than it would in penetrating sandstone.

(The committee then presented a report on creosoted oil mixtures.)

Dr. Von Schrenk: The creosote which we used to buy for 6 or 7 cents a gallon has risen to 18 and 20 cents, with decreased quantities available, at the time of an increased demand. Some 14 years ago experiments were tried on the Sauta Fe, using a combination of crude petroleum with creosote oil. About the same time, or a little before, similar treatments were carried out in other countries. As a result of inspections, we are impressed with the remarkable state of preservation of these mixed ties, but do not feel that it is wise to make any definite recommendation for incorporation in the Manual at this time. On this same general subject the committee wishes to say that by the end of next year it may be in a position to give specific recommendations where and how to use a combination of petroleum with zinc chloride.

(The committee was excused with the thanks of the Association.)

Report on Signs, Fences and Crossings

The highway grade crossing problem has grown to one of marked seriousness. This is reflected in the work of the Committee on Signs, Fences and Crossings, which presented this year a progress report on highway grade crossing separation which is the first of a series of detailed studies on this subject. Specifications for bituminous crossings and a number of descriptions of railway installations of substitutes for plank crossings were presented as information. A report was also submitted on the relative economy of steel, wood and concrete fence posts with detailed figures on the life of each. This indicated that wood was holding its own in the matter of relative economy. Maro Johnson has been chairman of the committee for three years and a member for the last ten years.

Maro Johnson
Chairman

THE COMMITTEE presented reports on: (1) Revision of the Manual in Appendix A; (2) specifications for bituminous crossings; substitutes for wooden crossing planks in Appendix B; (3) highway grade crossing separation in Appendix C; and (4) economy of steel, wood, and concrete fence posts in Appendix D. Considerable information has been collected on plans for concrete corner and end fence posts, but no report was presented.

The committee recommended:

1. That the changes in the Manual as recommended in Appendix A be adopted.
2. That the specification for bituminous crossings and matter relating to substitutes for wood crossing plank in Appendix B be received as information.
3. That the matter pertaining to highway grade crossing separation in Appendix C be received as information.

Herbert Hoover, through the Department of Commerce of the United States, has been endeavoring to bring about a reduction in waste in various industries. During the past year, action along this line has been taken with respect to the manufacture of woven wire fencing.

A survey showed 552 styles of fencing manufactured and 2,072 sizes of packages marketed. At a conference called by the Department of Commerce and help in July, 1923, at which fence manufacturers, selling agencies and various consuming organizations were represented, the number of styles of fencing to be manufactured, effective January 1, 1924, was reduced to 69, and the sizes of packages to 138.

Railroad interests were not advised of this conference at the time, and two of the styles appearing in the Manual are not included. The committee has been assured, however, by two of the largest fence manufacturers that fencing heretofore manufactured for railroad use will still be available.

Committee: Maro Johnson (I. C.), chairman; T. E. Rust (W. C. F. & N.), vice-chairman; Anton Anderson (C. I. & L.), Arthur Anderson (N. Y. C.), F. D. Batchellor (B. & O.), R. E. Chamberlain (B. & O.), W. E. Colladay (I. C.), D. T. Crawford (G. T.), A. Crumpton (C. N. R.), L. B. Curtiss (N. P.), G. N. Edmondson (N. Y. C.), A. B. Griggs (A. T. & S. F.), A. C. Harvey (N. Y. C. & St. L.), E. T. Johnston (Erie), S. C. Jump (I. C.), S. E. Shoup (K. C. S.), G. H. Smith (N. Y. C.), H. Stringfellow (U. S. R. A.), W. C. Swartout (M. P.), A. H. Utter (C. B. & Q.).

Appendix A—Revision of the Manual

Spacing of Anchor Posts in Wire Fences

The specifications for right-of-way fences on page 438 of the Manual do not contain an instruction for the spacing of anchor posts. At the suggestion of the Committee on Outline of Work this matter has been given consideration. The proper spacing of anchor posts is dependent upon the character of the soil, type and length of posts, climatic conditions, etc., but assuming average normal conditions as a standard, it is recommended that the following paragraph be inserted at the end of Section 15 on page 440 of the Manual:

> "In long runs of fence, anchor posts shall be spaced not more than one-quarter mile apart."

Strength of Fence Wire

Of 31 roads replying to a questionnaire on this subject, only four have specifications which give the ultimate tensile strength of wire. These vary from 1,400 to 2,200 lb. for No. 9 wire. The various classes of standard fence as given in the Manual contain No. 7 and No. 9 wire, while No. 12½ is used for barbed wire.

The ultimate strength of steel wire is given by au-

thorities as varying from 90,000 to 100,000 lb. per sq. in. Applying the smaller value to the above wires gives an ultimate tensile strength of 2,214 lb. for No. 7 gage wire, 1,554 lb. for No. 9 gage, and 686 lb. for No. 12½ gage. Line wire should be strong enough to resist the heavy strains of stretching, yet soft enough to permit splices to be made without breaking it. Stay wire should be somewhat softer than line wire for ease in bending about the line wire. The committee believed that these values will be satisfactory and recommended that the following paragraph be inserted at the end of Section 10, on page 440 of the Manual:

> "Wire for fencing shall have minimum ultimate tensile strength as follows:
>
> Line wire No. 7 gage.....2,200 lb.
> Line wire No. 9 gage.....1,500 lb.
> Line wire No. 12½ gage..... 700 lb.
> Stay wire No. 9 gage.....1,100 lb."

Specifications for Highway Grade Crossings

Last year this committee presented, and the Convention adopted for publication in the Manual, specifications giving grades and dimensions for highway grade crossings. The committee recommended this year the elimination of the words "where the topography is favorable" from the first line of Section 2, as these words so weaken the section as to give it little effect. It is where the topography is unfavorable that the construction described in this section is most needed. As amended it will read:

> "The grade of the surface of the highway should be level with the top of the near rail for a distance of 1 ft. outside thereof; should be 3 in. lower 10 ft. outside of the rail, and should be not more than 3 in. higher nor 9 in. lower than the top of the rail at points 30 ft. from it, measured at right angles thereto. The grade beyond these 30-ft. points should not exceed that which prevails in the section of the country for highways of the class under consideration."

Appendix B—Specifications for Bituminous Crossings

Bituminous crossings may be constructed by using either a bitumen that requires heating, or one that does not. The majority of bituminous crossings now being installed are of the type, using crushed stone as an aggregate, that does not require heating the bitumen, and the specifications herewith presented apply to this type. They cover the use of Headley Oil, an emulsified asphalt, and Astec Kolmend and Tarvia KP, cutback products. The committee has not sufficient information to tell whether they will apply to all other emulsified asphalts and cut-back products.

The question of flangeways is important. Some roads have found flangeways of other materials very necessary, while others have had but little trouble where the bituminous concrete is laid in contact with the rail and the wheels allowed to cut a flangeway. Those who use the latter method claim that the special flangeways of wood or steel permit water to get under the crossing and cause its failure. Where special flangeways are not used the crossing sometimes breaks down next to the rail and the drop of vehicle wheels from the top of the rail to the farther edge of the flangeway widens the flangeway and tends to make the paving material roll up toward the center of the track. It is probable that the amount and character of highway traffic should have consideration in determining whether special flangeways are necessary. Some roads are using successfully a thinner layer of the bituminous concrete than four inches as called for in these specifications.

Specifications for the Construction of Bituminous Crossings

1. General.—These specifications cover the use of emulsified asphalt and cut-back products in the construction of bituminous crossings. They must be carried out in detail and with good workmanship.

2. Foundation.—All the old ballast shall be removed for the full width of the crossing between lines, not less than two feet outside each rail and replaced with new ballast consisting of clean crushed stone and having a depth of not less than six inches below the bottom of the tie.

All ties not in good condition shall be removed and replaced with new ties (perferably treated ties) and fitted with tie-plates. All badly worn track material shall be replaced with new material, eliminating rail joints if possible.

The track shall be carefully lined and surfaced. The new ballast shall be thoroughly tamped to form an unyielding foundation, the surface of which, after being tamped, shall be four inches below top of rail. Provision should be made for draining the road bed.

3. Handling Materials.—Bitumens shall be thoroughly mixed before removal from the barrel.

Emulsified asphalt shall not be exposed to freezing temperature.

Cut-back products contain an inflammable solvent and care should be taken to keep them away from open flames.

Concrete in which a cut-back mixture is used shall be made and stored for at least five days before using. It shall be left uncovered to permit curing, but shall be protected from the rain.

4. Method of Constructing Pavement.—If an emulsified asphalt is used as the cementing agent, the following paragraphs shall govern:

Binder Course.—Upon the foundation of ballast there shall be placed an evenly spread layer of bituminous concrete which, after being thoroughly tamped, shall be 2½-in. in thickness with top surface 1½ in. below top of rail. It shall be made in the following proportions:

1 cu. ft. clean ballast stone,
⅓ to ½ gal. of bitumen.

The concrete shall be thoroughly mixed and the stone uniformly coated with the bitumen. This can be done by placing the stone upon a mixing board in a layer about six inches deep, adding the bitumen, and then raking or turning over the mixture with shovels.

Wearing Surface.—Upon the binder course there shall be spread evenly a layer of bituminous concrete, which after being thoroughly tamped, preferably with a self-propelled roller, shall be level with the top of rail, but not crowned. It shall be made in the following proportions on a mixing board in the same manner as the binder course:

1 cu. ft. ¾-in. clean stone,
1 gal. of bitumen.

Where the courses of the pavement are tamped by hand or with hand rollers the finished surface shall be from one-half to one-inch above the top of rail to allow for compacting by vehicles.

Seal Coat.—A seal coat of clean sand mixed with the bitumen shall be spread over the crossing to fill the voids, but not to make a layer. It shall be made in the following proportions:

1 cu. ft. wet. sand,
1½ to 2 gal. bitumen.

Flangeways.- Particular attention shall be given to thoroughtly compacting the bituminous concrete adjacent to wood or steel flange guards or rail heads. Where wood or steel flange guards are not provided and flangeways are cut by trains passing over the crossing, they shall be sealed by applying to the grooves a solution of two parts bitumen and one part water.

4-A. Method of Constructing Pavement.—If a cut-back product is used as the cementing agent, the following paragraphs shall govern:

Wearing Surface.—Upon the foundation of ballast there shall be placed an evenly spread layer of bituminous concrete, which, after being thorolghly tamped, preferably with a self-propelled road roller, shall be not less than four inches in thickness and level with the top of the rail, but not crowned. Where the pavement is tamped by hand or with hand rollers, the finished surface shall be from one-half inch to one inch above the top of rail to allow for compacting by vehicles. The bituminous concrete shall be made in the following proportions:

1 cu. ft. ¾-in. clean stone,
⅓ cu. ft. sand.
⅔ gal. bitumen.

The concrete shall be thoroughly mixed and the stone uniformaly coated with the bitumen. This can be done by placing the stone upon a mixing board in a layer about six inches deep, adding the bitumen, and then raking or turning over the mixture with shovels.

Seal Coat.—A seal coat of ¼-in. stone, pea gravel or coarse sand mixed with the bitumen shall be spread or crushed evenly over the crossing, only in sufficient quantity to fill the surface voids. It shall be made in the following proportions:

1 cu. ft. of aggregate,
1½ gal. bitumen.

Flangeways.—Particular attention shall be given to thoroughly compacting the bituminous concrete adjacent to wood or steel flange guards or rail heads.

5. Repairs.—Holes or pockets in the pavement shall be repaired as soon as they appear and a small quantity of material shall be stored properly, near the crossing, for this purpose.

Appendix C—Highway Crossing Grade Separation

The following was submitted as a progress report, the subject being too extensive to attempt more the first year of study.

Some measure of the importance of the highway crossing grade separation problem may be had from these facts: On Class 1 railroads in the United States there were on December 31, 1921, 252,002 grade crossings, with 485 eliminations during that year. On December 31, 1922, there were 256,362 grade crossings with 705 eliminations, a net increase of 3,655 crossings, according to the Interstate Commerce Commission's Bureau of Statistics.

The records of the Bureau of Public Roads show that there was spent on highways in the United States on State and County roads outside of cities, exclusive of engineering, administration and other expenses, for the fiscal year ending June 30, 1921, for—

Construction	$627,000,000
Maintenance	249,000,000
Total	$876,000,000

and that the total expenditures for the year ending June 30, 1922, was..... $898,000,000
The estimated expenditures for 1923 are... 943,000,000
The Federal appropriation for the year ending June 30, 1922, was..... 65,000,000
and for the year ending June 30, 1923.... 50,000,000
all of which was allocated to the States and spent on construction.
During the calendar year 1922 there was paid for vehicle licenses a gross of..... $152,047,000
For gasoline tax 11,923,000
The excise tax for fiscal year ending June 30, 1923, was 144,384,403

No data of a similar nature is at hand for Canada.

It has been estimated that to eliminate all the grade crossings in the United States would cost $12,600,000,000, or about two-thirds of the total value of the railroads, as established by the Interstate Commerce Commission for rate-making purposes.

The grade crossing has been brought to public attention by the marvelous development of the automobile. There are now in the United States 13,000,000 motor vehicles, or five for every railroad freight and passenger car, and it is estimated that 30,000,000 people ride in a motor vehicle every day, or an annual movement of eight times as many passengers as are carried on all the railroads.

The subject of highway crossing grade separation has for the purpose of this study been divided into 10 major items, and those subdivided into many details, as per the following outline. The committee reported this year on the first three major items, i. e., a resume of public requirements, federal, state and municipal, giving abstracts of detailed laws and requirements in numerous sections of the country by states, etc.

Appendix D—Relative Economy of Steel, Wood and Concrete Fence Posts

This general subject has been on the committee's assignment for several years, reports having been submitted in the years 1913, 1915 and 1918. During the past two years a large amount of additional information applying particularly to wood posts, and covering practically the whole country east of the Rocky mountains, has been received through the medium of questionnaires. These questionnaires were furnished old section foremen and others familiar with the installation dates of fences, so that fairly accurate information as to the past and probable future life of individual posts has been obtained.

STEEL POSTS

No. of Posts	*Total Post Years*	*Weighted Average Life*	*Simple Average Life*
83,399	1,883,369	22.58	18.1

Several roads reporting recent installations of steel posts are unable to give an estimate of probable life, but this indicates increased general use of steel posts. The weighted average life of those included in the report seems to be about the same as wood, namely, 22.5 years.

WOOD POSTS

Kind of Post	*No of Posts*	*Total Post Years*	*Weighted Average Life*	*Simple Average Life*
Cedar	67,842	1,527,662	22.5	23.6
Red Cedar	3,925	93,930	23.6	23.0
White Cedar	13,849	294,623	21.3	32.3
Mountain Celar	136,000	3,400,000	25.0	25.0
All cedars	221,616	5,316,215	23.98	23.9
Chestnut	23,769	455,710	19.1	23.5
Oak	196,645	2,373,262	12.0	18.8
Cypress	1,390	24,490	17.6	24.3
Creo. Pine	406	10,134	24.9	25.0
White Pine	640	13,440	21.0	21.0
Locust	2,600	54,474	20.9	22.3
Bois d'Arc	405,199	12,176,748	30.1	30.3
Walnut	40	840	21.0	21.0
Juniper	592	18,944	32.0	32.0
Mesquite	....	.....	....	12.0
Catalpa	...	.....	....	20.0
Red Wood	...	.....	....	10.0
All except cedars	631,281	15,128,042	23.96	22.8
Total—all posts	852,897	20,444,257	23.97	23.7

The simple average life of the fences reported is only 18.1.

Steel posts set in wet or swampy ground have a short life, five to eight years being the total reported for some posts. The manufacturers generally claim a probable life of from 20 to 25 years and the data seems to indicate this is about what to expect, Apparently the tubular, L-shaped or T-shaped posts will give about the same life under similar conditions.

CONCRETE POSTS

Date Installed	*No. of Posts*	*Total Post Years*	*Aver. Life*	*Remarks*
1906	239	4,287	18.0	75 gone in 1923. Life of balance estimated from present condition.
1910	957	18,639	19.4	278 failures to 1923. Life of those remaining estimated on present condition
1912	3,534	92,012	26.03	1,416 moved up to 1923 for cause
1913	37,614	1,880,700	50.	Conditions good, failures very few.
1914	262	12,936	49.7	Four posts removed to date. Condition balance good
1913 to 1917	213 361	10,668,050	50.	Failures very slight. condition good.
1916	116,000	5,800,000	50.	Failures very slight. Condition good.
	371,967	18,476,624	49.67	

It appears that cedar posts have a somewhat longer life in the north than in the south. The figures indicate that this may be four or five years. They also indicate that wood posts have a longer life in wet or swampy ground than on higher land, where the drainage is good.

Some roads report the use of creosoted ties removed from the track for various reasons as fence posts.

The table on concrete posts is based on information concerning approximately 372,000 posts. The committee has record of about 766,000 installed between 1905 and 1917.

The estimated life of posts put in from 1913 to 1917—not included in the above table—is reported as indefinite, present condition of posts good and failures few. Posts erected prior to 1913 were more or less experimental in either material or manufacture and failures were many.

Since 1913 concrete fence posts have been built along the lines of reasonably correct design and workmanship, and in view of the small number of failures in these later posts, it seems reasonably safe to assume for them a probable life of 50 years.

The cost of posts varies a great deal over the country. The average derived from the information collected is as follows for posts in place:

	COST
Concrete posts	72c each
Steel posts	58c each
Wood posts	52c each

The annual cost of the three kinds of posts having a life and estimated cost in place as shown in a number of tables attached to the report would be as follows:

Kids of Posts	*Est. Life, Years*	*Cost Installed*	*Annual Cost*
Concrete	50.	$0.70	$0.044
Steel	22.5	0.58	0.047
Wood, Average	23.7	0.52	0.041
Wood, Cedar	23.9	0.50	0.040
Wood, Shortest Life	12.0	0.41	0.048
Wood, Longest Life	30.3	0.38	0.034

Generally speaking, the wood post seems to hold its own with either steel or concrete, especially where local conditions as to fire or other destructive elements are favorable, and particularly where it is plentiful and the cost low. Local conditions would seem to be a large factor in determining which kind is the most economical.

Discussion

(The report of the committee was presented by Maro Johnson, chairman, who *moved consecutively that the revisions of the Manual in Appendix A on the spacing of anchor posts in wire fences and on the strength of wire fences be adopted. Motion carried.* Mr. Johnson next presented the revision of the specifications for highway grade crossings and *moved its adoption.*)

Hunter McDonald (N. C. & St. L.): If you strike out those words "where the topography is favorable" and adopt this rule as now proposed, you are going to find that, in a great many mountainous countries where highways have not been brought up to that state of perfection, you may be considerably embarrassed in litigation at highway crossings. With the rule as it now is, it will require a large number of railroads to spend a very large amount of money in reducing the grade of the approaches to their line in order to be in line with it.

G. A. Mountain (Can. Ry. Com.): I think, as an arbitrator between the public and the railways, those words should be left in because they are fair.

E. A. Frink (S. A. L.): If the position of the committee is not sustained and it is seriously considered restoring those words, I should recommend modifying them to substitute the words "where possible." That at least will do us as little harm as we can hope for.

Chairman Johnson: The committee will accept the change "where possible" suggested by Mr. Frink.

H. M. Lull (S. P.): I doubt the wisdom of putting in the words "where possible." It is a very broad term. It certainly would be *possible* if you wanted to go to the trouble and spend enough money to put in this form of construction anywhere. It is not an extraordinarily difficult matter. If we are going to insert any term of that kind I would suggest that it be something like "where reasonably practicable."

J. L. Campbell (E. P. & S. W.): I think it raises the question as to what co-operation there has been, if any, between this committee and the highway commissions of the various states. As far as this is merely a rule of this association, it would be within the province of the engineers of the railroad companies to decide whether this is practicable or not.

Chairman Johnson: The committee will give the rule further consideration.

(The remainder of the report of the committee was presented as information and accepted as such, after which the committee was excused with the thanks of the association.)

Report on Rules and Organization

The Committee on Rules and Organization presented a complete revision of the manual of instructions for the guidance of engineering field parties in order to clarify and at the same time make the instructions more definite. The new rules retain the form and substance of the previous ones. The committe also presented a complete revision of the manual of rules for the guidance of employees in the maintenance of way department. This was done in order to secure a better continuity of numbering and likewise to provide for the insertion of new rules in the future. It was recommended that these revised rules be substituted for the present recommendations in the Manual. W. C. Barrett has been chairman of the committee for four years and a member for the last six years.

W. C. Barrett
Chairman

THE COMMITTEE presented reports covering the following subjects: (1) Revision of Manual in Appendices A, B and C; and (2) Manual of rules for the guidance of employees of the maintenance of way department, in two Appendices, respectively D and E. It recommended: 1. That the changes in the Manual in Appendices A, B and C be approved and the revised versions substituted for the present recommendations in the Manual. 2. That the rules presented in an Appendix D be approved for printing in the Manual.

Committee: W. C. Barrett (L. V.), chairman; E. H. Barnhart (B. & O.), vice-chairman; D. P. Beach (Penna.), C. W. Brown (L. & N. E.), H. L. Browne (C. M. & St. P.), Carl Bucholtz (Erie), E. N. Burrows (Cornell Univ.), W. M. Camp (Railway Review), P. D. Coons (C. B. & Q.), C. A. Derr (S. & N. Y.), J. L. Downs (I. C.), H. H. Edgerton (C. G. W.), C. W. Engle (C. C. C. & St. L.), J. M. Fair (Penna.), H. H. Harsh (B. & O.), B. Herman (Sou.), B. R. Kulp (C. & N. W.), J. B. Mabile (C. R. I. & P.), E. F. Manson (C. R. I. & P.), R. N. Priest (A. T. & S. F.), R. E. Warden (M. P.), A. A. Woods (Sou.).

Revision of Manual

The committee presented in an Appendix A a complete revision of the manual of instructions for the guidance of engineering field parties, believing that the revision clarifies and makes more definite the instructions, while preserving the form and substance of the previous report. It also presented a complete revision of the manual of rules for the guidance of employees of the maintenance of way department in an Appendix B, to secure continuity of numbering and to provide for insertion of future new rules.

North and South Railroad

_____ Division Bridge No ____

Date _____

Condition of Structure
Deck
Stringers
Caps
Bents
Girder
Truss
Masonry
Paint
Repairs
Work Required to Keep Structure in Good Condition
Work Required to Keep Structure Safe

Daily Bridge Inspection Report

Appendix C—Daily Bridge Inspection Report

The committee submitted a revised form to be used in place of the form on page 619 of Manual, and forms on pages 617 and 618, which are to be omitted. In place of paragraph 25, page 616, of the Manual, the following paragraph was recommended for substitution:

25. Form 1110 of Committee XI, Records and Accounts, on page 510 of the Manual of 1921, covers periodical report of bridge inspection.

Discussion

(W. C. Barrett, chairman, presented the report of the committee and *moved the adoption of the manual of instructions for the guidance of engineering field parties for publication in the Manual. Motion carried.* Mr. Barrett next read the recommended rules for the guidance of employees in the maintenance of way department, during which a number of criticisms were made and discussed briefly. *It was subsequently moved that rule No. 750 now in the Manual be taken out.*)

Chairman Barrett: We reprinted all of the material that is already in the Manual only for the reason that it was necessary to do that in order to get proper continuity of numbering. In this case the rule is already in the Manual, there was nothing that the track committee had done which we could use as a guide or with which we could collaborate, and we, therefore, made this rule ourselves. We feel that it is hardly fair to the committee just because it happens to be printed in the proceedings this year, to take out a rule here and a rule there. The committee feels that it would suit its line of work better to handle these by criticism or recommendations during the course of the year, and the committee will be very glad to embody any of those criticisms or recommendations in its report from year to year. In that way rules now in the Manual can be taken out.

President Lee: The chairman of the committee has stated that this rule was put in because there was nothing that they could find that covered this particular subject. The Committee on Outline of Work states that this particular subject should have been covered primarily in the first instance by another committee. It seems to me the Outline of Work Committee is organized and well equipped to make a decision of that sort, and I am simply suggesting that if it finds a rule of that sort which it believes ought to receive the consideration of some other committee, as, for instance, the track committee or the rail committee, it be authorized to suspend temporarily the rule with a certain note retaining the place in the rules and organization report. The matter then could be referred to the proper committee for action. That seems to be the quick and direct method of handling questions of this sort.

J. L. Campbell (E. P. & S. W.): The only motion that I made was that this rule 750 be taken out of the Manual for the time being. There are a number of the other rules that I would like to include under this motion, but I understand the suggestion of the chair is that the question of all such rules be referred to and left at the discretion of the Committee on Outline of Work as to suspending them until they have been properly considered by the appropriate committee. I am not just clear on how that would work. I don't believe that I care to make that particular motion. The chairman of the Committee on Outline of Work desires to present a motion to the association, and on that account I desire to withdraw my motion for the elimination of rule 750, with the consent of my second. *(Motion withdrawn.)*

M. Coburn (Penna.): Now, since the beginning, this committee has been in a position where it could very easily trespass on the work of other committees and it has had a difficult path in that respect. It has been the idea of the board that it is now the committee's province to collect the information prepared by the other committees and bring it into the Manual for the use of the employees of the maintenance of way department. It is not the intention that this committee shall settle things which are in the proper field of the other committees. *I move that this report be accepted as progress and that it be referred back for further consideration. We will see that the other committees that are affected will have a chance to make any criticisms they wish to make and be ready for publication in the Manual after the meeting next year.*

E. A. Frink (S. A. L.): If this set of rules is referred back to the committee, I think they should go over them with the idea of deciding whether some of the clauses or some of the rules do not more properly belong to a specification rather than to a set of rules.

G. J. Ray (D. L. & W.): During the past year the Outline of Work Committee has had an impossible proposition

in the way of attempting to get the work of this committee and the standing committees harmonized in such a way that this conflict that we are talking about will not exist. The point raised by Mr. Frink is unquestionably a good one and it is the real crux of the whole thing. There is still a big task to get the material, that is now in demand, in such shape that it may not conflict with or be contrary to the specifications which are really a part of other portions of the Manual, or should be. It is the idea of the Outline of Work Committee that the whole matter that is shown here before you today ought to be gone over thoroughly between this committee and the several standing committees. Now the Outline of Work Committee cannot be a clearing house, that clearing house must be through co-operation between the committee now on the floor and the other committees. It can't be worked out in any other way.

(*Motion carried.*)

(The committee was excused with the thanks of the association.)

Report on Co-operative Relations with Universities

This, the newest committee to be organized, has embarked on an elaborate study which has for its principal objectives the stimulation of a greater appreciation on the part of railway officers of the value of technically trained men in their organizations, the more general application of the laboratory and other research facilities of the universities to the solution of railway problems and the stimulation of greater interest among engineering students in the science of transportation. This committee includes both railway and college men. It held one meeting, where a broad program was adopted. Robert H. Ford, chairman of this committee, is an experienced railway engineer who has retained a close interest in college affairs since his graduation from Norwich university in the year 1892.

R. H. Ford
Chairman

THIS COMMITTEE was created as a result of a steadily increasing desire within the Association, and responsive suggestions from leading universities for a better and more reciprocal relation between the institutions of higher learning and the vast transportation agencies constituting the North American railway system.

The scope of its work, as laid down by the Board of Direction, was designed to stimulate: (1) A greater interest upon the part of railroad officers in assisting the universities to develop the best possible methods for the technical courses. (2) A better means of bringing to the university the results of our deliberations, where such can be made of value to them. (3) A better means of bringing to the attention of the railroads the benefits of a technical education, thereby acquainting them with the qualifications of graduates of these courses for initial service in subordinate positions, and at the same time providing material from which men may be drawn for higher positions as they demonstrate their fitness. (4) A means of stimulating a greater interest in the science of transportation among engineering students who may be inclined toward this branch of industry. (5) A means whereby the facilities of the universities may be made more directly available for the research work of the Association by co-operative effort between their laboratories and the Committees of the Association. (6) A means whereby the universities may be better enabled to educate the students and the public regarding the value of transportation to the nation, as a whole. (7) A means of stimulating a greater interest among university officials in the study of transportation and economics and impressing them with the importance of experienced men for such teaching.

The committee is now organized, and while its work is yet in a somewhat preliminary stage, it has advanced to a point where constructive progress can be expected during the coming year.

The subject matter is not only of the greatest importance, but the opportunities for aiding the public, the universities and the railroads to the end that a better understanding may be gained, not only of transportation in its relation to the economic development of the country at large, but also the mutual assistance which this Association, by properly directed effort, may secure for the railroads and for those great training agencies constituting the American and Canadian universities.

The railroads will gain if full co-operation with unisities can be brought about by (1) bringing into the railroad organizations, a larger group of broadly trained young men, fully prepared for initial service in subordinate positions, with opportunity for growing into larger responsibilities; (2) by securing a much larger use of equipment and personnel of the universities in various research problems of the railroads, looking to their economic use and development. The combination of railroad and university staffs on these problems must greatly inure to the benefit of both, but especially to the railroads. (3) Bringing about a much more thorough knowledge of transportation, history and problems by college teachers, and by securing their co-operation in creating an intelligent public sentiment, not only among students, but in more general ways such as their summer sessions and extension and other public lectures, and writing for magazines and the non-technical press. The universities will gain through such co-operation by securing an additional outlet to useful service for their students, in a larger use of their research staff and equipment, and by securing more free access to valuable in-

struction material such as reports and specific problems, involving details of railway transportation.

There must be no consideration of selfish interests of either party to such co-operative arrangement. The universities have a special duty to serve in any way that makes for the greatest public good. Any steps that can tend to bring about a fuller understanding of the correct relationship between the public and the great transportation agencies is public service.

Committee: R. H. Ford (C. R. I. & P.), chairman; R. N. Begien (C. & O.), vice-chairman; W. C. Cushing (Penna.); J. M. R. Fairbairn (C. P. R.); W. D. Faucette (S. A. L.); E. T. Howson (*Railway Age*); E. B. Katte (N. Y. C.); M. S. Ketchum (Univ. of Ill.); Brig. Gen. C. H. Mitchell (Toronto Univ.); C. A. Morse (C. R. I. & P.); G. J. Ray (D. L. & W.); Wm. G. Raymond (State Univ. of Iowa); H. E. Riggs (Univ. of Mich.); H. R. Safford (C. B. & Q.); W. B. Storey (A. T. & S. F.) and George F. Swain (Harvard Univ.).

Discussion

R. H. Ford (chairman): This committee was created as a result of a steadily increasing desire within the Association and responsive suggestions from leading universities for a better and more reciprocal relation between the institutions of higher learning and the vast transportation agencies.

There are unmistakable evidences that a profound economic change is under way, affecting all lines of industry, including the railroads, the character and scope of which is not readily understood, nor can it be easily grasped. The effect of this is, in some degree, reflected through various technical associations and other organizations which are working on the lines somewhat similar to that work assigned to this committee.

The railroads will gain if full co-operation with universities can be brought about:

By bringing into the railroad organizations, a larger group of broadly trained young men, fully prepared for initial service in subordinate positions, with opportunity for growing into larger responsibilities.

By securing a much larger use of equipment and personnel of the universities in various research problems of the railroads, looking to their economic use and development.

By bringing about a much more thorough knowledge of transportation history and problems by college teachers, and by securing their co-operation in creating an intelligent public sentiment, not only among students, but in more general ways, such as in their summer sessions and extension and other public lectures, and writing for magazines and the non-technical press.

The universities will gain through such co-operation by securing an additional outlet to useful service for their students, in a larger use of their research staff and equipment, and by securing freer access to valuable instruction material, such as reports and specific problems, involving details of railway transportation.

As the deliberations of the committee crystallize, the results will form the subject matter for the individual members to use in their contact with other technical associations, as well as with the railroads and the engineering schools. These results will also be used through some form of territorial or special committees from among the members of this Association, to whom the results of the committee conferences will be transmitted. The committee has been really overwhelmed with the assistance and support that we have had so far since its organization, and especially so from the universities and colleges. I think I voice the sentiment of the committee when I say that our problem is very largely with the railroads.

(The committee was then excused with the thanks of the Association.)

Closing Business of the Association

C. A. Morse (C. R. I. & P.) presented the following resolution on the proposed revision of the I. C. C. Accounts:

RESOLVED, that the American Railway Engineering Association in convention assembled looks with deep concern upon the proposed revision of operating accounts of the railroads.

Economy of maintenance of way and structures is dependent upon such detailed accounting as will provide a record of the cost of doing different classes of work common in all carriers, and such records should be kept in a uniform manner to permit of comparison of such costs between the different operating divisions of a railroad and between different railroads, and we further feel that such uniform records are necessary to permit the I. C. C. to properly apply the requirements of the Transportation Act.

(The new president, Mr. Ray, then took the chair and the convention adjourned.)

American Railway Engineering Association Registration

A TOTAL OF 30 members and 7 guests registered during the closing sessions of the A.R.E.A. convention yesterday, bringing the total registration to 785 members and 202 guests, or a combined total of 987. This compares with a total registration of 665 members and 168 guests, or a combined total of 833 last year, and establishes a new high record of attendance for the Association, exceeding the previous maximum of 859 in 1922 by 15 per cent.

Ambrose, J. R. W. (Director), ch. engr., Toronto Terminals, Toronto, Ont., Canada.
Balliet, H. S., asst. term. mgr. and sig. engr., Grand Central Terminal, N. Y. C., New York City.
Bennett, W. R., div. engr., Wabash, Springfield, Ill.
Breed, Chas. W., office engr., C. B. & Q., Chicago.
Brewer, W. A., engineering dept., C. & N. W., Box 532, Lombard, Ill.
Chipman, Paul, val. engr., P. M., Detroit, Mich.
Cooper, G. K., asst. engr. construction, Chicago Union Station Co., Chicago.
Crawford, D. T., supt., G. T., Battle Creek, Mich.
Gamble, J. S., asst. engr., Wabash, Montpelier, Ohio.
Gerst, H. A., asst. bridge engr., G. N., St. Paul, Minn.
Hartvig, C. E., asst. sig. engr., C. R. I. & P., Chicago.
Heritage, C. S., bridge engr., K. C. S., Kansas City, Mo.
Hurd, G. R., supt. fire protection, I. C., Chicago.
McFadden, J. H., div. engr., M. P., Nevada, Mo.
Montgomery, C. R., office engr., M. K. T., St. Louis, Mo.
Morgan, A. L., ch. engr., D. M. U., Des Moines, Iowa.
Oberdorf, C., principal asst. engr., F. E. C., St. Augustine, Fla.
Penfield, W. H., engr. m. of w., C. M. & St. P., Chicago.
Radspinner, W. A., engr. operation, B. & O., Richmond, Va.
Ray, W. M., asst. engr., B. & O., Pittsburgh, Pa.
Routzahn, C. A., asst. div. engr., Wabash, Springfield, Ill.
Scott, H. E., asst. engr., Wabash, Montpelier, Ohio.
Shoup, S. E., eng. asst. to gen. mgr., K. C. S., Kansas City, Mo.
Thompson, F. L., ch. engr., I. C., Chicago.
Tuthill, Job, ch. engr., P. M., Detroit, Mich.
Vent, F. G., asst. engr., I. C., Chicago.
Wardle, J. D., ch. engr., C. R. & I. C., Cedar Rapids, Iowa.
White, R. C., gen. supt., M. P., St. Louis, Mo.
Whitenton, W. M., vice-pres. operation, M. K. T., Dallas, Tex.
Wilks, J. R., asst. engr., C. R. I. & P., Trenton, Mo.

Guests

Arms, L. E., Portland Cement Assn., Chicago.
Cudroff, Henry M., engr., I. C., Chicago.
Ege, C. R., Portland Cement Assn., Chicago.
Hart, W. E., Portland Cement Assn., Chicago.
Laidlaw, C. O., G. T. W., Detroit, Mich.
Litchiser, R. R., Portland Cement Assn., Chicago.
Rohr, E. J., super. b. & b. & track, Cincinnati, Ohio.
Shieber, J. H., asst. bridge engr., M. P., St. Louis, Mo.
Walcott, Ray O., draftsman, G. T., Chicago.

The Signal Section in Session at the Drake Hotel Yesterday

Signal Section A. R. A. Convenes at Drake Hotel

Record Attendance Considers Eight Committee Reports and One Paper in Busy Day's Session

THE SIXTH ANNUAL convention of the Signal section, American Railway Association, opened at the Drake hotel yesterday morning with an attendance of 448 as compared with 471, the attendance for last year. The attendance at yesterday morning's session is considered as a record for the opening registration. As quite a number of additional members will register at today's session, this should make the total attendance for this meeting higher than that of any previous meeting of the section. Approximately 25 per cent of the entire membership were present.

B. T. Anderson, (C. & O.), chairman, presided. Eight committees presented reports at the meeting yesterday.

The secretary reported a total membership of 1,824 as of March 15, 1924. In his report appears a summary of the membership under different classifications. The report also went into detail as to the number of meetings held by the different committees and the number of subjects considered and acted on.

Chairman's Address

After the opening business had been disposed of B. T. Anderson, chairman of the section, in his address touched on the record movement of heavy traffic made by the railroads during the past year and the noteworthy advances in signaling. He pointed out that signal systems have been utilized to a greater extent than ever before and also stated that more trains are being operated against traffic by signal indication without train orders than in the past and that more remote controlled switches are being operated than in the past. Continuing Mr. Anderson said:

"Railroads are making a more careful check of the economy of signal installations. One report of the Signal section showed that by the use of proper signaling on 17 railroads over 200,000 train stops were eliminated per year at an estimated annual saving of over $600,000.

"The elimination of derails at grade crossings, as adopted at the November stated meeting of the Signal section, marks a very progressive step in signaling practice and should result in safety of operation and economy in installation and maintenance.

THE TRAIN CONTROL QUESTION

"Probably the outstanding feature of the year has been the increase in train control installations and the increased interest in the train control question. Probably no phase of signaling has received so much study in the past year as that of train control. * * * * Since last March, committees of signal, operating, mechanical and engineering department officers of many railroads have been endeavoring to decide on the best type of automatic train control, which would fit the particular needs of their railroads. On January 14, 1924, the Interstate Commerce Commission issued a second order requiring 45 additional railroads to install automatic train control over a complete passenger engine division by February 1, 1926.

"Two orders of such magnitude, affecting as they do so many railroads not equipped with signaling systems, has created an unusual interest in signaling subjects. The orders have raised questions of far-reaching effect to those in charge of the signal departments on the 94 railroads.

"The proper length of block must be determined, depending upon the braking curves for the grades, traffic and operating conditions on each railroad. In the past, blocks were from 4,000 to 10,000 ft. in length. Now, block lengths of 7,000 to 17,000 ft. in length are considered proper under certain conditions. It seems probable that on railroads of light traffic the block limits may be miles in length.

"Many railroad men are asking the question, 'Can train control in its present state of development be installed without the use of wayside signals?' One test installation without wayside signals has been placed in

service. The majority of railroad men are applying train control on the basis that wayside signals are desirable.

"Perhaps these simple problems are easy to solve as compared with that of choosing a proper type of train control. The ramp devices were first in the field. They have been in service on one steam railroad for over 10 years. In view of this record it is interesting to note that the majority of the 49 railroads have adopted the induction system of the intermittent or continuous type.

"At this time there are about 330 road miles of ramp type train control in service, about 110 miles of trial installations of the induction type in service and about 340 miles of permanent installations of the induction type under construction. The total mileage of all types is 780 road miles.

"After having adopted a system of train control, there remains the question of the power system. Should a direct or alternating current system be chosen? Fortunately the members of the Signal section through their committees are in a most favorable position to help in solving these questions, and no doubt during the coming year information on these and other phases of automatic train control will be made available.

B. T. Anderson
President

"Our membership has increased about 160 in the year. We have grown from a membership of 1,237 in 1914 to about 1,800 in 1924, a gain of 50 per cent in 10 years. Our expenses have dropped from about $36,000 per year in 1922 to about $29,000 in 1923. The committee expenses have kept well inside the budget allowance. It is a great source of satisfaction to be able to report that the business of the Signal section is being handled in such an economical and businesslike manner. * * * *

"In my opinion, we stand at a very important time in signaling history. The manner in which the problems of today are solved will serve to make signaling of the greatest value to the railroads.

Work for the Signal Section to Do

"I would like to call your attention to a few of the important questions which the Signal section should act upon.

"Assist in developing a unified train control system, a system which will perform satisfactorily on all railroads operating over joint territory.

"Assist in developing a reliable train control system. The available records indicate that the failures of automatic train control systems greatly exceed those of automatic signals. This is, no doubt, due to the lack of development of train control as compared with that of automatic signals.

"In 1910, it was stated that 'the automatic control of trains is still very much in its elemental stage.' Some railroad men still believe it is in its elemental stage.

"You may have noticed that I suggested that the Signal section 'assist in developing' a unified and reliable control system. With the talent and the experience of our members, the Signal section is properly qualified to solve this question. * * * *

"The Signal section should secure adoption of a standard set of color indications. Committee V called attention to this question in its report at the November, 1923, meeting. There is a lack of uniformity among the railroads. Some railroads are still using white for clear, where a broken lens or a misplaced lamp will give an improper signal indication.

"Design economical systems. Without exception practically all railroad men cannot understand the high cost of railway signaling. It is a fact that automatic signals and interlockings 20 years ago were considered inexpensive, while today it seems necessary to float a bond issue to make signaling improvements. Signaling is primarily one of economics. It is an interesting fact that the first idea of operating a number of switches and signals from one control point, in 1840-1845, was done mainly for the reason of economy to save the labor of switchmen. With the advent of train control it is all the more necessary that some means be provided for reducing the high cost of signaling to a normal basis.

H. S. Balliet
Secretary

"Develop adequate records. Such records are vital when comparison of cost data, signal operation and comparison of service records of wire and train control are under discussion. Many roads are now finding it necessary, in the times of higher wages, to form adequate organizations to obtain a proper system of records. We should have standardized record systems for the use of our membership.

"Recommend educational systems. In these days of extensive signal work the field for trained signalmen is unlimited. Some railroads are prepared by educational systems to find a suitable place from which to pick men for their needs. The future reports of Committee V on this subject will be watched with interest.

"Distribute literature on signal subjects. A few signal reports have been abstracted and prepared in condensed form for the use of all railroads. This practice has greatly increased the interest of those who do not usually come in direct contact with railway signaling. More of the Signal section's conclusions should be prepared and distributed in this manner."

Tribute Paid to W. W. Slater

Out of respect to the memory of W. W. Slater, the regular order of business at yesterday morning's session was stopped long enough to pay tribute to his work in the signal field. T. S. Stevens (A. T. & S. F.), in paying tribute to Mr. Slater's work, pointed out that he was the dean of the signal engineers. Continuing, he said in part:

"Many never knew what an important part Mr. Slater had in signal development. Many of you perhaps did not know that Mr. Slater was the first man properly to locate signals for track signaling so that they would not cause train delays. And it was through him, I think, that single track signaling became an economic factor in handling trains as well as providing protection without a lot of delay which would take place if his particular arrangement of signals around a passing track was not used.

That is history and not recorded, I believe." Following Mr. Stevens' tribute, a resolution in memory of W. W. Slater, was ordered spread on the records.

Report of the Committee of Direction

The Committee of Direction, in its report, called attention to certain matters upon which it had acted during the period from March 15, 1923, to March 12, 1924. Among these items may be mentioned the following:

The chairman was authorized at the solicitation of the Operating division to appoint a committee of three men to represent the Signal section in joint conference with the Operating Rules committee, to revise the block and interlocking rules.

It has been decided that one paper of interest to the Signal section be presented at every meeting.

The holding of the Stated meeting for September, 1924, at the New Ocean House, Swampscott, Mass., September 23, 24 and 25 was approved.

It was considered desirable to copyright or patent A.R.A. Signal section drawing No. 1546 covered by the Special Committee on Highway Crossing Protection. It was thought prudent to limit the use of this standard design to locations where highways cross railroad tracks at grade. No legal way has been found to obtain the copyright or patent, therefore other means are being undertaken to restrict the use of this design at crossings.

Consideration was given during the year to re-establishing Sectional committees. A careful analysis of all of the details developed into a study of the entire subject and interchange of considerable correspondence with individuals interested in it. A sub-committee of the Committee of Direction and a sub-committee of the Committee on Committees conducted these investigations. It is the conclusion of the Committee of Direction that Sectional committees be not re-established at the present time.

Committee V—Instructions, has been instructed to investigate and report on what is being done in the way of education of foremen, other subordinate officers, and maintainers in the signal departments by means of meetings or clubs.

Signaling on the Illinois Central

H. G. Morgan, signal engineer of the Illinois Central, presented a paper on the application of alternating current supply with battery reserve for signal systems. Mr. Morgan explained in detail the advantages of the a.c. floating battery system as in service on several signal installations on the I. C. He stated that for a three-track signal bridge location, where the a.c. floating system is installed, the cost is $400 less than if the straight a.c. system had been put in, and it is the experience of the I. C. that the cost of maintenance of the two systems is about equal. Line voltages of 220 volts or 440 volts are used for supply and are carried on the telegraph pole lines without any serious interference with communication.

Committee Reports

The Special Committee on Highway Crossing Protection, in presenting its report, asked that certain changes be made in line with information presented and collected since the November stated meeting. There was some discussion on the drawing of the disc for wig wag signals presented by the committee, the opinion being expressed that the disc should be red instead of white, but on a vote of the section the standard as prepared by the committee was approved.

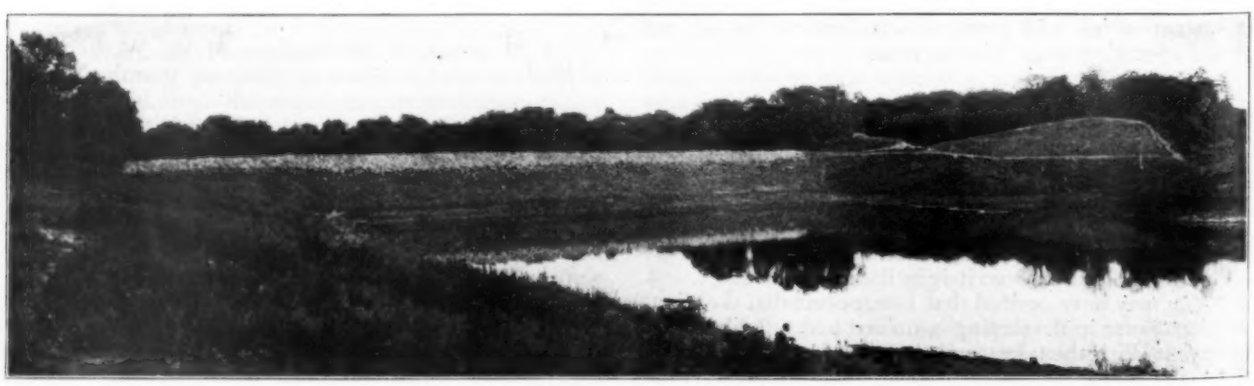
Committee II—Mechanical Interlocking, was presented by W. F. Zane (C. B. & Q.), vice-chairman. The first subject taken up was specifications for electro-mechanical interlocking machines with unit electric levers, I. S. & F. locking. This report was accepted for submission to letter ballot for inclusion in the Manual.

Committee No. V—Instructions, submitted a report through Chairman J. S. Gensheimer (Penn.). This committee report was mostly on the wording of the different paragraphs presented in order that there should be no opportunity for misunderstanding as to their intent.

Committee XI—Chemicals, presented for inclusion in the Manual a report on specifications for motor gasoline. Committee VI—Designs, presented five revised drawings and five new drawings, including drawings for electric lamps and adapters, mechanical dwarf signals, enameled steel signal blades, a base for a oneway wall machine, and the bonding of manganese frogs. A revision of the specification for one-inch wrought iron pipe was also recommended by this committee.

Yesterday's program was completed early enough so that three committees listed on today's program reported yesterday afternoon. The first committee to report, following the Committee on Designs, was the Committee on Contracts and Valuation. This committee was followed by the Committee on A.C. Signaling which presented a complete discussion and recommendations as to methods of line charging of storage batteries used for automatic signaling. The report of the Committee on Signaling Practice was brief but important, in that it recommended that derails in main tracks be abolished. The adoption of this report by the Signal section will form a definite basis on which the railroads can formulate their pleas to state commissions for the removal of derails. The Committee on Economics of Railway Signaling will be the first one to present its report at this morning's session.

* * *



Dam for the Burlington's New Reservoir Near Galesburg, Ill.